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PREFACE.

AT the request of some of my Ambulance Pupils, I publish these Lectures, and hope they will prove of service to them as well as to others.

For the excellent diagrams which illustrate these pages, I am indebted to MR. GILBERT THOMAS, of "The Graphic."

The syllabus of the St. John's Ambulance Association has been strictly adhered to, as these are Lectures given to their classes.

SAM. OSBORN.

10, MADDOX STREET,
REGENT STREET, W.
June, 1885.

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FIRST AID.

LECTURE I.

Preliminary Remarks, object of Instruction, &c.; A general outline of the Structure and Functions of the Human Body, including a brief description of the Bones, Joints, and Muscles; The Functions of Respiration and of the Nervous System.

THE object of these lectures is to give you certain knowledge that upon an emergency you may be ready to assist any injured person, and to give immediate assistance; that life may be saved through such timely aid, and suffering relieved until professional help is obtained.

The course of instruction will include the various means of arresting bleeding, the signs of a broken limb, and the necessary assistance to be given in these accidents, as well as the immediate treatment of suspended animation in cases of drowning.

That "accidents happen in the best regulated families" is well said; and whilst accidents are of daily occurrence, a knowledge of how to render first aid to the injured is of the greatest importance.

What you have to learn is, to render that assistance which must be immediate to be of any good. How many people die from there being no medical man at hand to save them? And this is what we aim at preventing, by the knowledge you will attain in these lectures. It behoves us also, as examiners, to be very strict in the examinations which are held at the termination of these lectures, and as to whom we give certificates of efficiency; for to these persons do we intrust the lives of injured people, by placing in their hands a certain amount of surgical knowledge.

A little knowledge, they say, is a dangerous thing; and therefore it behoves us to see that you do no harm if you do no good.

But good, even great good, you can do; and that is why I am ready to teach you. Remember that these lectures are not given to make you amateur surgeons, nor to enable you to act independently of professional help, but merely to assist in saving life and relieving pain until that help can be procured.

In order that you should understand the different directions that will be given you, and the means for their adoption, a slight knowledge of the structure and functions of the human body is necessary.

We will begin, then, with the framework of our human tenement, viz., the skeleton; and subsequently cover it with muscles, &c., and enclose within it the several important organs by which "we live and move and have our being."

The skeleton serves as the basis for the origin and insertion of the several muscles which move our limbs, as well as for forming cavities for the reception and protection of important organs, such as the heart, lungs, and nerve centres.

Bone, of which the skeleton is composed, is one of the hardest structures of the animal body, as well as being at the same time light and elastic.

Its lightness is obtained by the central portion of all bones being honeycombed or cancellated, and in which is contained the marrow and nutrient blood-vessels, whilst the external portion is more dense and of compact structure. Lightness of some of the bones—those of the forehead for instance—is obtained by their being hollowed out to contain air. This is seen to greater advantage in the bones of birds, thereby enabling them to fly the more easily through the air.

Elasticity of bone is seen especially well in the ribs, which easily bend in the process of respiration. This is well known to the little Arab children, who frequently make use of the ribs of camels for their toy bows.

Bone is made up of one-third of animal matter, and two-thirds of earthy matter; the former predominating in the bones of young people, the latter predominating in those of the aged.

Strength and solidity to many of the long bones is given by a firm buttress or ridge of bone extending its whole length; so that the bone is not cylindrical, as is generally supposed, but prismatic, and of the same form as the spokes of a wheel, which are made of this shape so as to impart strength.

Beginning at the top of the skeleton is the head. In the skull (1), which to all external appearances looks like one bone, we find no less than eight bones entering into its formation, and fourteen into that of the face. They are all immoveably united together with the exception of the lower jaw or inferior maxillary bone (2), which is free, to allow of rotatory movements for the process of mastication.*

The globe of the head is supported on the spine or vertebral column, which is made up of twenty-four bones called vertebræ. Those forming the neck (cervix) are seven in number, and are called cervical vertebræ (3); those for the back (dorsum) are twelve in number, and called dorsal vertebræ (4); and those for the loin (lumbar) are five in number, and called lumbar vertebræ (5). They increase in size from above downwards, and for the most part take their name from their numerical order from above downwards. The first cervical vertebra receives, however, the name of the atlas, as Atlas supported the globe; and the second cervical vertebra is called the axis, as it is upon this

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* The numbers refer to the corresponding bone in the small *diagram of the* skeleton (Fig. I).

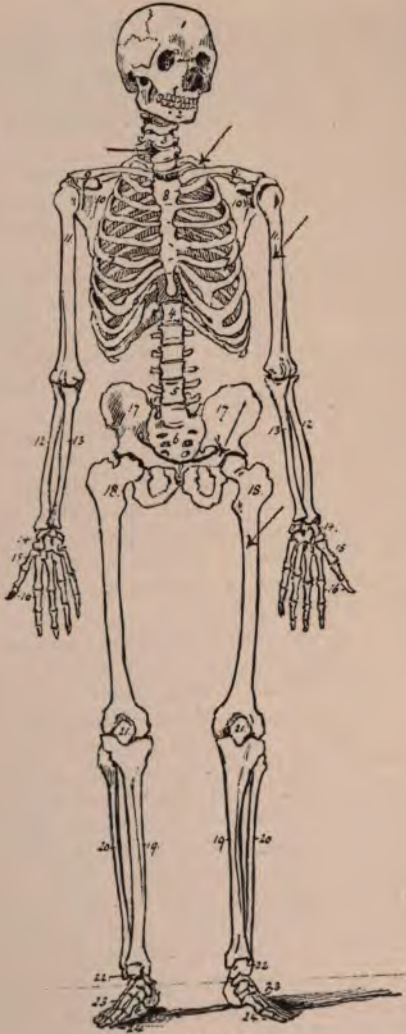
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FIG. I.

bone that the head rotates, as it were, on a pivot. The other vertebræ are called third and fourth cervical, and so on downwards to the termination of the cervical region; then first and second dorsal vertebræ, and so on down to the commencement of the first lumbar.

At the lower part of the vertebral column is a wedge-shaped bone called the sacrum (6), and which, forming the seat, is composed of five vertebræ welded together; beyond and below this again are four more rudimentary vertebræ, called the coccyx, and which is the counterpart of the tail.

Springing from either side of the dorsal vertebræ are the ribs or costæ (7), twelve on each side, twenty-four in all. A dorsal vertebra can always be distinguished from a cervical or lumbar one by the small facets situated on the outer sides, to which the ribs are joined. The male subject has the same number of ribs as the female, although many are apt to say, on the strength of their Biblical knowledge, that the male has one less. The upper seven pairs of ribs are attached by cartilaginous prolongations to the breast-bone or sternum (8), and are called sternal or true ribs; the remaining five, not being so attached, are called asternal or false ribs, the two lowest of which, by reason of their being perfectly free, are spoken of as free or floating ribs.

The upper extremity is attached to the trunk by a very slender bony attachment in comparison to the lower extremity; the reason for this is that in the former great mobility is required, whereas in the latter strength and solidity are necessary to support the weight of the body.

The collar-bone, or clavicle (9), is the only bone attaching the upper extremity to the trunk, which it joins at the upper and outer side of the sternum. As this is the most slender bone in the arm, it is the one most frequently broken by falls upon the outstretched hand.

Lying upon the back of the ribs, and attached to the clavicle, is the wing-shaped bone called the shoulder-blade or scapula (10), suspended from the rounded socket of which is the upper arm or humerus (11).

From the elbow downwards to the wrist, forming the forearm, are two bones called the radius (12) and ulna (13); the former is on the outer side, and the latter on the inner.

When I speak of outer and inner, I mean with reference to a median line drawn through the centre of the body; and when standing at attention like a soldier, with the little finger touching the seam of the trowsers, the radius or thumb-side will be outermost.

The wrist, or carpus (14), is made up of eight small bones, and beyond the carpus, to form the palm, are five bones called the metacarpal bones (15).

The finger bones or phalanges (16) are fourteen in number, three for each finger and two only for the thumb.

The lower extremity shews much greater strength, and the bones are all much larger than those of the upper extremity.

Two large haunch-bones, or os innominata (17), spring out on either side of the sacrum, to form the pelvis, and join together in front. Fitting into a deep cup-shaped cavity, on the under surface of the os innominatum, is the largest bone in the skeleton, the thigh-bone or femur (18). Below this from the knee is the shin-bone or tibia (19), on the outer side of which is the most slender and consequently most easily broken bone in the leg, the peroneal bone or fibula (20).

A small pan-shaped bone or patella (21) is placed over the knee-joint, and is what is generally known as the knee-cap.

Forming the instep are seven bones, collectively called the tarsus (22); and beyond these are the five metatarsal bones (23), to form the tread of the foot, and fourteen phalanges (24), three for each toe, with the exception of the great toe, which has only two.

You are well able now to see the great resemblance *there is between* the upper and lower extremities; one bone to form the upper part of the limb, two the lower; whilst in the one we find carpal, metacarpal, and phalangeal bones, in the other are tarsal, metatarsal, and phalangeal bones.

You see also that the bones thus joined together form certain cavities, two in number, one being again subdivided. The first is formed by the bones of the skull and the holes running down through the centres of the vertebræ, and contains the brain and spinal cord.

The other forms the trunk, and is divided into two compartments by a large muscular curtain called the diaphragm, which is attached to the lower margin of the ribs. The upper division is the chest or thorax, the lower the abdomen or peritoneal cavity.

The boundaries of the thorax are the dorsal vertebræ behind, the ribs on either side, the sternum in front, and the diaphragm below, and in which is contained the heart and lungs.

The boundaries of the abdomen are the diaphragm above, the lumbar vertebræ and sacrum behind, and the os innominata and muscular walls of the abdomen in front and at the sides. The lower bony basin-like portion of this cavity is called the pelvis. Within the abdomen is contained the stomach, intestines, liver, kidneys, and genito-urinary apparatus.

When speaking of cavities, I do not wish you to understand that when filled with their contents there is any space left, because Nature abhors a vacuum; consequently the elasticity of the walls of the chest and of the abdomen allows of any alteration in size of the contained viscera, whether by the entry of air into the lungs or by the entrance of food into the alimentary canal.

These three cavities have each a lining membrane to shut them off completely from external parts. The one for the brain is called the meninges of the brain and spinal cord, that for the lungs the pleural membrane, and that for the abdomen the peritoneal membrane. These several cavities, when inflamed, take the familiar names of meningitis, pleurisy, and peritonitis. The function of their several contents, embracing the brain and nervous system, the lungs and respiratory system, and the heart and circulation, we shall discuss later on.

Bones are connected together by ligaments (1, Fig. II.), and a joint formed.

Joints are of three varities. 1. Immoveable, as in the joining together of the bones of the skull.

2. Moveable, as at the elbow and hip joints.

3. Mixed, or a combination of the two preceding varieties, as found between the vertebræ forming the spine.

The construction of a moveable joint varies according to the required movements, and consequently we find hinge joints, and ball-and-socket joints.

Covering the ends of the bones where they come in contact is a mass of gristle, called interarticular cartilage (2, Fig. II.), placed there to prevent any severe concussion taking place between the two bone surfaces. This cartilage, when situated between the vertebræ is called intervertebral substance, which, acting as a buffer, prevents any jarring of the spinal cord, which would otherwise take place in jumping or leaping.

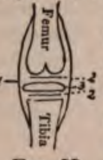

FIG. II.

The interior of the joint is lined by a closed sac or synovial membrane (3, Fig. II.), which secretes a glairy fluid, called synovial fluid, to lubricate the joint, and allow of its moving freely and easily. This fluid is excessive when any injury affects the joint, as in a sprain, and is deficient in some diseases, for instance gout.

Muscles are the organs of locomotion, and comprise what we understand as the flesh of an animal. Every muscle takes origin from some bone to be inserted into another, with the object of moving that one to which it is inserted. They are somewhat similar to bands of elastic, and are endowed with contractility, so that when in action they become harder and shorter.

Muscles are given names, either from their action as the flexors and extensors of joints, from their situation as the intercostals between the ribs, or from their origin as the biceps muscle of the arm, which arises by two heads (bis, capitis).

Muscular tissue differs in structure according as to whether it is under the control of the will or not; and hence it is divided into voluntary and involuntary muscular fibre.

Voluntary or striped muscular fibre is composed of numerous fleshy bundles bound together, like faggots, by an enclosing sheath or sarcolemma. When examined microscopically they are found to break up into shreds, in a similar manner to stewed rhubarb, and to be striped transversely; and thus the name of voluntary or striped muscular fibre. All muscles which we have the power of moving are of this variety.

The enclosing sheath surrounding the muscle is prolonged at either end, to form the tendon of attachment.

Involuntary or unstriped muscular fibre is made up of long spindle-shaped cells, with a central spot or nucleus, and which are fitted together like the tiles of a mosaic pavement. They form the walls of blood-vessels and of the intestinal canal,—in fact, all those parts of the body over which the will has no control.

The only exception to this rule is the heart, which is composed of striped muscular fibre, but over the contractility of which we have no power.

Muscular tissue is peculiar in this respect, that it is not worn away by use, but increased and strengthened, as seen in the large muscular development of all active men.

The lungs, situated in the chest and enclosed in the pleural membrane, are divided into five lobes (2, Fig. VI), three of which are placed on the right side of the *thorax and two* on the left, the remaining space on this side being occupied by the heart. The lining membrane, previously spoken of as closing in the upper chest cavity, is reflected over the lung itself; and we therefore speak of the visceral pleural membrane, or that covering the lung or viscus, and the parietal or costal pleural membrane, which covers the walls or ribs. The bag thus formed secretes a serous fluid, to allow of the lungs moving easily when expanding and contracting in respiration.

The substance of the lung is made up of a number of air-cells, arranged on tubes or bronchia in a similar manner to the arrangement of leaves on a tree, the branches increasing in diameter as they near the trunk; so do the bronchial tubes become bronchi, and go on increasing in size till they terminate in the trachea, or windpipe.

The air-cells are surrounded by a very fine network of blood-vessels, called capillaries, only one branch of which lies between each air-cell; so that the blood in its interior is exposed to the action of the air in the cells on either side of it.

The cells themselves always contain air, which is continually being changed in the process of respiration. This muscular process, by which the air is continually being altered in the lungs, is called inspiration and expiration, the latter being slightly longer in point of time than the former.

The mechanism of inspiration is effected by the elastic tissue present in the bronchial tubes, by the muscles situated between the ribs, and which are called intercostal muscles, and also by the diaphragm, that large muscular curtain which divides the body in half. The latter muscle contracts, pushing the abdominal organs downwards, and, attached to the lower margin of the thorax, holds the ribs firmly down whilst they are straightened and drawn upwards by the action of the intercostal muscles. Ordinary expiration is effected by the elastic recoil of these same muscles from a state *of contractility;* whereas in forced expiration other muscles are brought into action, the chief of which are the abdominal muscles.

The air which is continually being changed at each expiration (14 to 18 times per minute) is called ordinary breathing air; whilst the air which can be expelled over and above this by forced expiration is called complemental air, and that which remains after this, and which cannot be expelled, is called residual air. This last becomes purified by the law observed in the diffusion of gases.

Roughly speaking, fresh air consists of four parts ot nitrogen gas to one of oxygen. This is the composition of the atmosphere which is constantly being carried into the air-cells of the lung.

The blood contained in the capillaries on their exterior takes up the oxygen, and gives off carbonic acid gas and watery vapour. This carbonic acid gas which is given off is a product of decomposition, and its separation into the gaseous form creates warmth, and keeps up the natural heat of the body.

You naturally will ask, Of what use, then, is the nitrogen? Probably you may at some time or other have seen at some chemical lectures that bodies burnt in oxygen gas burn with far greater brilliancy than in ordinary air. Well, we should do the same if only this gas was present, and live our lives far too rapidly; and, consequently, nitrogen is present solely to dilute the oxygen.

Respiration produces changes in the blood and in the air. The former is changed from dark crimson venous blood to bright scarlet arterial blood by the process of oxygenation, and fitted once more for the nutrition of tissues; whereas the latter is robbed of oxygen, and impregnated with carbonic acid gas and watery vapour.

The function of the nervous system is for rendering that motor power by which voluntary motion, respiration, circulation, and digestion are carried on.

Nerve tissue is made up of white threads, which we call nerve fibres, and masses of nerve matter, which we call ganglia. The fibres convey impressions to and from the ganglia in the same way as the wires convey from a galvanic battery electric shocks. There are, however, two varieties of wires or nerves for conveying impressions, viz., motor and sensory nerves, both of which are perfectly distinct, and neither have the power of fulfilling the duties of the other.

Every nerve-centre or ganglion can originate a power which, transmitted by a motory nerve-fibre connected with it, accomplishes some required purpose or movement; whilst other sensory nerve-fibres have the power of conveying impressions to the nerve-centre from their terminal extremities. For instance, on a prick from a pin on the hand the sensation is brought to your knowledge by a nerve of sensation. You immediately and involuntarily withdraw your hand, and this movement is accomplished by a nerve of motion. Consequently, nerve-fibres conveying sensations are called nerves of sensation, and nerves which transmit impulses of movement are called nerves of motion.

Knocking the funny bone is really a blow applied to a sensory (ulnar) nerve.

The nervous system is subdivided into the sympathetic or nerve system of inorganic life, and the cerebro-spinal or nerve system of organic life, both of which have ganglia and nerves of motion and sensation connected with them.

The sympathetic nerve system influences involuntary motion, digestion, secretion, and nutrition. On the entry of food into the stomach, for instance, the sympathetic nerve causes the secretion of the gastric juice, which aids digestion. In this case the food is the irritant to the terminal ends of the sensory nerves found in the stomach, whilst the secretion of the gastric juice is accomplished by the motor nerves.

Again, when any wound is present on the arm or leg, the nerves of sensation are irritated by the same, and a larger supply of blood being required at that situation, to heal the wound, the nerves of motion increase the blood-vessels to the required size.

The cerebro-spinal system has, as its name implies, the brain and spinal cord as its central batteries, from which motor and sensory nerves are given off. Connected also with the cerebro-spinal system are the nerves of special sense, viz., smelling, seeing, hearing, and tasting.

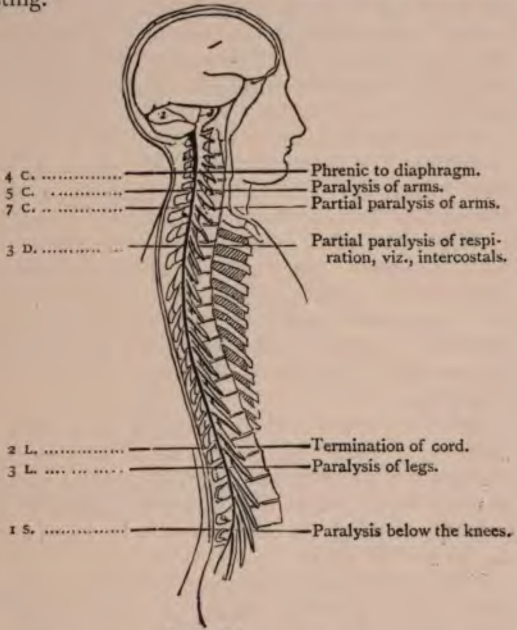
4 C.
5 C.
7 C.
3 D.
2 L.
3 L.
1 S.
Phrenic to diaphragm.
Paralysis of arms.
Partial paralysis of arms.
Partial paralysis of respiration, viz., intercostals.
Termination of cord.
Paralysis of legs.
Paralysis below the knees.

FIG. III.

The brain is a mass of nerve-ganglia and nerve-fibres, and is divided into three parts, called cerebrum, cerebellum, and medulla oblongata.

The cerebrum (1, Fig. III.), or larger brain is the seat of intellect, the emotions, and will; and occupies the *front* and upper portion of the skull.

The cerebellum (2, Fig. III.), or little brain lies at the posterior part of the skull, and is the seat of co-ordination of movement, enabling us to walk regularly without necessarily taking cognisance of it. For instance, the removal of one half of it in a pigeon occasions the bird to fly lop-sided.

The medulla oblongata (3, Fig. III.), is the connecting medium between the brain and spinal cord. The nerve fibres coming from each side of the brain here cross one another; so that paralysis on one side of the body is not due to disease on the same side of the brain, but on the opposite side.

Remember to bear this in mind, then, that in cases of apoplexy or extravasation of blood upon the brain from injury, the cause of the paralysis is on the opposite side to that on which the paralysis is situated.

The spinal cord is a cylindrical column of nerve fibres and nerve ganglia, from which spring thirty-one pair of nerves, going to the different parts of the body. So, if the spinal cord is injured, as it frequently is in injuries to the spine, all parts of the body supplied by nerves below the joint of division will be in a state of paralysis.

A broken spine is not necessarily fatal, but a broken neck is. By referring to the accompanying sketch of the cerebro-spinal nerve system (Fig. III.), you will see at what region the several nerves are given off, and the consequent paralysis which must take place according to the seat of injury.

The sciatic nerves are given off on a level with the upper sacral vertebræ (sacral plexus), and supply the parts principally below the knee. The nerves on a level with the lumbar vertebræ (lumbar plexus) supply the leg above the knee.

The nerves on a level with the upper dorsal vertebræ supply the intercostal muscles, and consequently, if the injury is above this point, respiration will be interfered with.

The nerves for the arms (brachial plexus) are given off on a level with the lower cervical vertebræ; and then if the injury is above this point, paralysis of the arms would be present as well as paralysis of all the parts below.

The (phrenic) nerve which supplies the diaphragm comes off on a level with the fourth cervical vertebræ, and consequently any injury above this would cause instantaneous death from stoppage of respiration; as paralysis of the other respiratory muscles would be present—viz., the intercostal muscles, which are supplied by branches from the dorsal region, as well as paralysis of the diaphragm.

LECTURE II.

A brief description of the Blood, Heart, Arteries, and Veins; The function of the Circulation; The general direction of the Main Arteries, indicating the points where the Circulation may be arrested by Digital Pressure, or by the application of a Tourniquet.

The difference between Arterial, Venous, and Capillary Bleeding, and the various extemporary means of arresting it.

THIS, the second lecture of the course, will be of the greatest use to you; it is, of all the lectures, the most important. It deals with hæmorrhage and the various means of arresting it; and when a patient may die in a few moments from loss of blood, your knowledge must be literally at your finger's ends to apply immediately.

The blood, which is the bearer of nutritive material to all parts of the body, is composed of blood-corpuscles and a clear, colourless fluid called liquor sanguinis, which is the fluid portion of the blood in which the corpuscles float.

The corpuscles are of two kinds, red and white. The red are the more numerous, and the white the larger.

The red corpuscles give the colour to the blood, and in form are bi-concave discs; and when viewed edgeways are very similar in shape to dumb-bells, and on removal from the body have great tendency to adhere together in rolls, like a pile or rouleaux of coins. It is partly by this means that a clot is formed and blood coagulated. If a foreign body, such as a piece of thread, or any uneven surface, exists in the interior of a blood-vessel, the same coagulation or clotting of the blood will take place.

White corpuscles are spherical in shape, and have a central spot or nucleus. It is from the splitting up of the white corpuscles that red ones are formed. The fluid portion of the blood is made up of serum holding fibrine in solution, and which, on exposure to air, sets in a similar manner to what gelatine does; and this is another reason for the solidifying of blood on the exterior of the body.

The heart is the (striped) muscular organ by which the blood is pumped over the body. The pipes by which the blood is carried to the different parts are called arteries and the return pipes are called veins. The arteries spring from the lower part and the veins from the upper part of the heart.

The heart in shape is not like what you see on a valentine, but has a more truncated base and apex. Its relative size for any individual is that of the two fists placed together.

The heart is situated slightly to the left side of the chest. The point or apex is about a couple of inches below the left nipple and one inch nearer the median line, and is seen to strike the chest wall between the fifth and sixth ribs. It is divided into four chambers, the two upper ones being called auricles (1 and 3, Fig. V.) and the two lower ventricles (2 and 4, Fig. V.).

The auricle and ventricle of each side communicate with one another, but the two vertical halves of the heart are quite distinct; the blood on the right side having to pass through the lungs (6, Fig. V.) before reaching the left side. The two auricles contract or empty themselves simultaneously into the two ventricles, and these subsequently contract and empty themselves into the arteries springing from them. Two sounds are thus produced, sounding very much like the words lubb-dubb if the ear is placed over the region of the heart. The blood passing from the auricles into the ventricles, the return of the blood back again into the former, is prevented by the presence of valves situated between them, and which are very similar in form to the semi-circular valves present in the interior of veins (A, Fig. IV.), to be described hereafter. Similar valves are placed at the junction of the main arteries with the heart for the same purpose of preventing any return of blood into the ventricles when they dilate.

Every time the left ventricle of the heart contracts, a wave of blood is sent onwards throughout all the systemic arteries in the body. This is called the pulse; and although we are in the habit of associating it with the pulsation of one of the arteries at the wrist, you must at once get rid of the popular idea that there is only one pulse, that of the wrist; but remember that wherever an artery is present a pulse is present also. The pulsation of the temporal artery on the temple of old people is exceptionally well seen and felt. The pulse giving the number of contractions or beats of the heart per minute shews the strength and regularity of the circulatory system.

In newly-born children its average rapidity is about 140 per minute, in the middle-aged, 70 to 75, decreasing in rapidity as age advances. In females it is always more frequent than in males.

The pulse is taken at the wrist simply for the sake of convenience, and is done by placing the *fingers gently* over the (radial) artery.

The reason why the thumb is not used is that the arteries in it are larger than those in the fingers, and consequently one's own pulsation might be felt instead of that of the patient.

Care should be taken that only gentle pressure is used, or the current of blood in the vessel will be shut off altogether. It is usual to take the number of the pulsations in fifteen seconds, and then to multiply the same by four.

Arteries are cylindrical tubes, which serve to convey *the blood* from the lower part of the heart to all parts *of the body.* The walls of arteries are made up of *(unstriped)* muscular fibres and elastic tissue. The muscular fibre is for the purpose of regulating the size of the vessel, and the elastic tissue to allow of the tube dilating and contracting when blood is propelled along it, as well as for permitting the tube being bent when the limbs are in motion; for if the artery was hard and rigid it would be liable to break when the limb was moved or a joint flexed.

The blood, after leaving the arteries, has to traverse some very small vessels called capillaries. A capillary vessel is about 1-3,000th of an inch in diameter; and its smallness may be judged of when I tell you that only one small blood corpuscle can pass along it at a time.

Veins are like arteries in structure, but their walls are less strong; and, having to do up-hill work—viz., to return the blood from the extremities to the trunk, —they have self-acting valves placed in their interior (A, Fig. IV.) to prevent the blood passing except in one direction, and that is onwards and upwards to the heart. These valves are semi-circular in form and cup-shaped, with their free edge turned inwards and upwards, so that when well filled with blood any passage of the blood backwards is prevented by the approximation of the free edges (B, Fig. IV.).

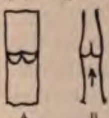

FIG. IV.

The wave of blood through the arteries which occasioned the pulse is lost by the time it reaches the capillaries, and therefore no pulse is present in veins.

The circulation of the blood, commencing at the left ventricle (2, Fig. V.) of the heart by the aorta (f), courses throughout the whole arterial system. From the arteries the blood enters into capillaries; from capillaries into veins. The veins again empty themselves by the venæ cavæ (g) into the right auricle (3), whence the blood passes into the right ventricle (4). This completes what is called the systemic (5) or larger circulation.

The venous blood is then carried by the pulmonary arteries (b) to the lungs (6), to be purified; and which, when accomplished, is brought back again arterialized by the pulmonic veins (a) to the left auricle (1). This is termed the pulmonary or lesser circulation.

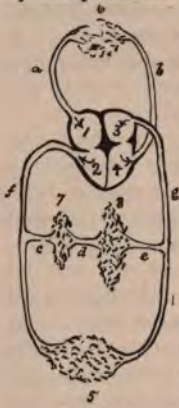

FIG. V.

Purple blood, then, is present on the right side and red blood on the left side of the heart. The red light, as the sailor says, on the port or left side of the ship.

There is yet another subordinate circulation called the portal or liver circulation. Blood carried by the mesenteric arteries (c) passes in close contact to the intestines (7); and, taking up nutriment therefrom, is carried by the portal vein (d) to be purified by filtration through the liver (8), and re-enters the venous system by the hepatic vein (e).

This will be better understood by reference to Fig. V., showing a posterior view of the three circulations.

The object of the circulation of the blood is to convey, by means of the arteries, oxygen and nutritive material to all parts of the body, and to remove by the veins all used-up and refuse material. It is necessary, then, that some organ is placed between the venous and arterial systems, for the purpose of transforming the former into the latter; and the lungs are therefore placed at the end, so to speak, of circulation for this purpose.

The main arteries of the body spring from the left ventricle of the heart by one common trunk called the aorta (f, Fig. V.).

The aorta arches upwards, and then descends in the middle line of the body: forming first an arch, then lying in the thorax, and afterwards in the abdomen, it receives the three appropriate names of arch of the *aorta, thoracic* aorta, and (after perforating the diaphragm) abdominal aorta.

From the arch are given off three branches, going to the head and upper extremities: one, the innominate, for the right side, and the remaining two, left carotid and left subclavian, for the left side.

This is the only situation where any difference of arrangement exists between the two sides of the body. The innominate artery, situated on the right side only, goes to the sterno-clavicular joint and divides into the right carotid and right subclavian arteries; whereas the left carotid and left subclavian arteries spring directly from the arch of the aorta, without any intermediate innominate branch.

The further description of the arteries on one side of the body is identical with that on the other. The carotid artery passes upwards to a level with Adam's apple (thyroid cartilage), and divides into the internal and external carotid arteries, the former supplying the brain and internal parts of the skull, the latter the face and external parts.

The subclavian artery arches outwards behind the collar bone; and, running down the middle of the axilla or armpit, is called the axillary artery after crossing the lower border of the first rib. At the lower border of the breast, or pectoral muscles, the axillary becomes the brachial artery, and lies close to the inner margin of the biceps muscle to about an inch below the bend of the elbow; where the brachial divides into two branches, the radial artery for the outer and the ulnar artery for the inner side of the forearm.

The ulnar continues straight on to the palm, and, curving outwards, unites with a small branch from the radial to form the superficial palmar arch. If the thumb is put at right angles to the palm, a line drawn straight across the palm from the end of the thumb will give the exact situation of this arch, from which at right angles are given off digital branches to the digits, or fingers. The radial artery continues straight down to the wrist, and then passes backwards to go between the thumb and first finger. It is an injury to this artery, and not to a nerve, that is to be feared in wounds of this situation; and although this has given rise to the popular fallacy that lock-jaw frequently follows this injury, it is not the case here more than elsewhere.

The radial artery finally arches inwards to join a small branch from the ulnar to form the deep palmar arch. This arch lies about one inch above the superficial palmar arch, nearer the wrist-joint.

To return now to the abdominal aorta, which terminates at the lower border of the fourth lumbar vertebra by dividing into the right and left common iliac arteries. The common iliac artery passes outward to the sacro-innominate joint, where it divides into internal and external iliac arteries. The internal iliac supplies the internal parts of the pelvis, whilst the external iliac passes externally to supply the leg. On crossing the brim of the pelvis it is called the femoral artery, and continuing down the middle of the upper two-thirds of the front of the thigh, winds round to the back, at the junction of the middle with the lower third, to become the popliteal artery. The popliteal lies deeply placed at the back of the knee-joint, protected on either side by the hamstring muscles.

About a couple of inches below the knee-joint the popliteal divides into two main branches,—the anterior tibial artery and the posterior tibial artery. The former comes through the space between the tibia and fibula, to supply the anterior portions of the leg, whilst the latter continues onwards posteriorly.

The anterior tibial lying on the instep passes between the great toe and the next, to get to the sole of the foot; and the posterior tibial, lying behind the inner ankle, passes on to the sole of the foot, and unites with the anterior tibial to form (plantar) arches in a similar manner to what took place in the hand, and from which spring branches to supply the toes.

These arches, like everything else in the human body, have a definite purpose, although the presence *of two sets may* appear to you superfluous. Standing upon the feet with the weight of the body above, or grasping an oar, racquet, or cricket-bat, would possibly be quite sufficient to shut off the blood in the superficial one of these arches; and, consequently, to prevent the fingers, or digits, becoming numbed and the hold relaxed, the blood is able to travel round by the deeper arch.

You see again what I previously told you, how the arrangement of not only the bones but also the vessels in the upper extremity correspond with those in the lower extremity. For, going from the trunk to the elbow or knee, there is one bone and one main vessel; whilst from the elbow or knee to the hand or foot, there are two bones and two main vessels; whilst in the palms of the hands and soles of the feet, these two vessels branch and unite together to form arches. The course of the arteries I have just described to you is the usual one, but you must bear in mind that occasionally they go irregularly.

Veins for the most part take the same names as the arteries they accompany; for instance, iliac, femoral, and popliteal veins for the leg, and innominate, subclavian, axillary, brachial and radial and ulnar veins for the arm.

There are, however, a few exceptions; for instance, the vein accompanying the abdominal aorta is called the inferior vena cava, which receives the blood from the two innominate veins; and that accompanying the carotid is called the jugular. In some instances the veins are called venæ comites, on account of their accompanying arteries.

All the veins from the lower extremity converge to the inferior vena cava, whilst those from the head and upper extremities converge to the superior vena cava, both of which empty themselves into the right auricle (3, Fig. V.).

But the fact that veins contain impure blood makes it necessary that their contents are returned to the heart as speedily as possible. Therefore a double set of veins are present in both the arm and leg, viz., a superficial set and a deep set.

The two superficial veins in the leg are very important by reason of their being frequently affected with varicosity. The long saphena vein runs upwards from the foot on the inner side of the leg, to empty itself into the femoral vein, and the short saphena vein comes from the outer side of the foot and leg to empty itself into the popliteal vein. The anatomy of these parts should be well borne in mind, as they are of importance in discussing the much vexed question of gartering above or below the knee.

Having considered the direction of the main arteries in the body, we will now pass on to the indication of those points where the circulation may be most easily arrested. The means by which this is effected are either by the finger (digital pressure) or by the application of a tourniquet.

Something has to be said concerning the advantages and disadvantages of these two means of arresting bleeding. Digital pressure cannot be kept up for an unlimited time, because of the fatigue to one's fingers. Relays of assistants to relieve one another could be adopted, and this is occasionally done in hospitals for the cure of diseased arteries. But when a patient has to be removed some distance, digital pressure is out of the question, and then a tourniquet must be applied, which, if efficiently done, will arrest all bleeding, and allow of the patient being safely moved from place to place.

Digital pressure is most useful, as in the absence of any appliance, one is enabled to put a finger immediately upon the artery above the point of bleeding and arrest the flow of blood until some other appliance of a permanent character is got ready.

So important is this knowledge of how to apply digital pressure, that I always refuse to grant a certificate of efficiency to any candidate under examination *who fails in this* particular, however well up he other*wise may be.*

For digital pressure to succeed in shutting off the current of blood to the parts beyond, two things are necessary: the artery must be superficially placed, and a bone be in close proximity, so as to form a resisting barrier to the pressure of the fingers.

There are five points where digital pressure can be applied. These several places are shewn on the small diagram of the skeleton (Fig. I.) by arrows pointing towards the bone on which pressure is made.

The common carotid artery can be compressed by pressure with the thumb directed backwards and inwards upon the cervical vertebræ. This is brought into use in cases of cut throat or wounds in the upper part of the neck. Supposing you are compressing the right carotid or right subclavian artery, you should use your left thumb for the purpose, and for the left side the right thumb.

By this means the fingers lie upon the back of the patient, and the concavity formed by the thumb and first finger fits accurately round the neck.

The subclavian artery is compressed by the thumb pressing downwards and inwards upon the first rib and above the collar-bone. This is especially useful in cases of hæmorrhage from the armpit. For instance, a page-boy, in cleaning a window on some steps, falls with his arm through the window-pane, some of the glass of which divides the axillary artery.

Pressure upon the subclavian artery may be kept up for even a longer time by using, instead of the thumb, an ordinary door-key, around the handle of which a piece of linen rag or lint has been twisted. The works of the key being held in the hand, the protected handle is pressed firmly downwards upon the vessel.

In cases where the bleeding comes from a situation lower down in the arm, compression of the brachial artery by the fingers pressing outwards upon the humerus can be more easily effected.

It is occasionally said that the inner seam of the coat sleeve gives the line of the brachial artery; but from loss of blood, or weakened by long-continued suppuration, without any further loss of blood which would prove fatal.

The same condition is here produced by compressing the main artery, as what we speak of as a limb "having gone to sleep" when lying upon the arm in bed, or when one leg is crossed over the other. When the current is allowed to return, the sensation of "pins and needles" is produced by the blood returning to its former place.

Bleeding differs in its character according to the nature of the vessel from which it flows.

In discussing a divided vessel, I shall speak of its distal end and its proximal end; by this, meaning that the proximal end is the end of the divided vessel nearest to the heart, and the distal end that farthest away from it.

Blood coming from an artery is of a bright vermilion or scarlet colour, and flows generally from the proximal end of the divided vessel. It comes away in spurts, which are due to the contractions of the heart; but between each spurt, the flow of blood does not entirely cease, for a continuous stream is kept up by the contractility of the blood-vessel.

Blood coming from a vein is dark purple in colour, wells up from the wound, and in a healthy vein flows only from the distal end of the divided vessel.

The only exceptions to arteries containing red, and veins purple blood, is found in the pulmonary arteries (b, Fig. V.) springing from the right ventricle, and in the pulmonary veins (a), bringing the arterial blood from the lungs (6) to the left auricle (1).

Capillary bleeding does not consist of a stream of blood coming from any one point, but is made up of a general oozing from the whole surface of the wound, the blood coming from a number of minute points.

Before passing on to the various modes of arresting bleeding, I wish to remind you of the structure of the s of blood-vessels, viz., in their being composed of muscular and elastic coats as well as having an outer enclosing sheath; all of which play an important part in the closure of a ruptured blood-vessel. When a vessel is divided, several things occur: its elastic coat retracts up inside the sheath; its muscular coat contracts and lessens its calibre, and the blood passing over the roughened end of the divided vessel, clots in the manner previously described. Frequently, when an artery is torn across, it will not bleed at all, on account of the sheath being so twisted round and round, and the vessel itself so retracted, that it is completely closed. This is the reason why gunshot wounds and railway accidents are not more frequently fatal, because the vessels are torn across and twisted, and not cleanly divided as they would be in sabre cuts. Thus nature assists in the arrest of hæmorrhage. But moreover, blood as it flows has increasing coagulating power, and the heart's action growing fainter, so large a quantity of blood is not sent onwards. You see, therefore, the error of administering stimulants to a patient faint from loss of blood, as thereby the circulation of the blood and its outflow is increased.

The methods of arresting bleeding may be divided into temporary and permanent means.

Temporary
- 1.—Direct pressure.
- 2.—Compression of artery above the wound. digital or instrumental.

Permanent
- 1.—Application of cold.
- 2.—Styptics.
- 3.—Cauterisation.
- 4.—Pressure.
- 5.—Torsion.
- 6.—Ligature.

Direct pressure is pressure applied directly upon the bleeding point, and a surgeon need never fear bleeding from an artery on which he can lay his finger.

all coat sleeves are not sewn in alike, and generally the seam is far too forward. A better plan is to place the fingers at the back and inner side of the arm, and feel for some cord-like bodies which slip away from under them. These are the nerves with arteries between them. With the thumb on the outer side, and the palm behind the arm, it is grasped firmly and the artery compressed. This is a better plan than grasping the biceps muscle from the front, which in some instances is all that is done, the artery being left out altogether; also, the flat of the fingers is to be used for pressure, and not the tips of the fingers, which would pinch the patient.

The femoral artery is most easily compressed in the groin on the innominate bone, or brim of the pelvis by pressing directly backwards. The thumb or thumbs are used for this purpose, as some force has to be used, and consequently, greater power is present in the thumbs than in the fingers. This is adopted in cases of hæmorrhage high up in the thigh, or if the limb has to be amputated. Candidates fail in this compression through applying their pressure too high up, and over the lower soft parts of the abdomen. Feel first for the prominent part (anterior superior spine) of the innominate bone, and then take the mid-point between this and the middle line of the body, and about a couple of inches below will be found the artery.

When bleeding is coming from a situation lower down the leg, the femoral artery is compressed at the junction of the upper and middle thirds of the thigh by pressing the fingers backwards and outwards upon the femur; the concavity formed by the fingers and thumb going round the front of the thigh.

It is not a bad plan to mark upon the surface of the body with red paint the course of the main arteries in the body, and then the candidates can apply their fingers at once upon the several arteries and learn to compress them efficiently. You can always tell whether your compression is properly applied by feeling the pulse below the seat of compression, and which will be present or not as pressure is taken off or put on.

A tourniquet is an instrument made to keep up instrumental compression upon an artery, and many varieties are in use, viz., field, horse-shoe, and ring tourniquets; but the most useful is the one you can improvise for yourselves.

A piece of coal, a pebble, pocket knife, or other substance, is tied in the centre of a handkerchief; this pad is placed over the top of the blood vessel, which will be either the brachial or the femoral artery, as those are the only vessels upon which a tourniquet is ever placed. The handkerchief is kept in position by being tied on the outer side of the limb, and a drum or walking-stick is then tied into the handkerchief where it is being knotted. Several circular turns are then given to the stick, so that the handkerchief is tightened and the pad brought sufficiently close upon the blood-vessel to shut off the current through it.

Either end of the stick is tied by another handkerchief to the lowest part of the limb, to prevent its becoming untwisted when the patient is moved from place to place.

This you can easily apply with materials you have to hand when any injury takes place: for instance, on a railway platform, when either extremity has been smashed by some passing train. A band of elastic simply wound round and round the limb on the stretch, and fastened by tapes attached to the end, answers all the purposes of a tourniquet.

An elastic bandage (Esmarch's) applied in a similar manner from the end of the limb upwards, so as to expel all the blood out of it, and keep it so by the application of an elastic tube above the bandage after removal, is one of the most useful appliances in surgery. By this means, an operation can be performed upon a patient who may be already much collapsed from loss of blood, or weakened by long-continued suppuration, without any further loss of blood which would prove fatal.

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Compression of the artery above the wound has been already described, both digitally and instrumentally.

The application of cold or ice causes contraction of the muscular coat of the blood-vessel, and therefore its calibre is lessened, and if already small in size, it is blocked completely, and hæmorrhage arrested.

Styptics act in the same way in causing contraction of the muscular coat. Those most easily obtainable are vinegar and water, alum or spirit and water, and if used as a gargle, are very useful in cases of bleeding from the mouth—for instance, after tooth drawing. Perchloride of iron, or a solution of iron filings in water, is also used, but it is disagreeable, as it tends to blacken the parts so much from the action of the iron.

Cauterisation, or the application of a red-hot iron, was the only mode of arresting bleeding known to the ancients, but at the present time is seldom adopted. A twisted piece of telegraph wire, or a hair-pin stuck in a cork and made red hot in the fire, will answer this purpose. This mode of arresting bleeding is applicable to soft parts that will not hold a ligature, or for capillary oozing.

Pressure is applicable chiefly in capillary oozing, the mere pressure of a bandage being oftentimes sufficient to arrest it. It is also used for the arrest of hæmorrhage from a ruptured varicose vein.

Varicose veins occasionally burst, either from ulceration or from injury. Old persons are especially liable to such accidents. Here pressure, either by a pad over the wound or a pad above and below it, with careful bandaging from the foot upwards, is the proper treatment. The blood in these cases comes mostly from the proximal end of the vein, because a varicose vein being a diseased and dilated one, the valves no longer act, and therefore the blood can pour away from the upper end. Elevation of the limb then must be also adopted.

Bleeding from veins in a healthy wound seldom requires treatment, because the valves being perfect, no blood can flow backwards from the heart.

The common practice of binding a piece of raw meat to the subcutaneous capillary hæmorrhage present in a black eye or bruise is an example of treatment by pressure ; the coldness of the raw meat adding another factor to the mode of treatment.

Again, in the serious and sometimes even fatal hæmorrhage which frequently follows the removal of a tooth. After mild measures, such as the application of cold or ice, and the use of styptics, have failed, pressure must be adopted. This is carried out by plugging the cavity; and the very best answer I ever had given me to this question was from a carpenter, who said he should take a common screw from his basket, and, wrapping a piece of linen rag round it, push it into the cavity from which the tooth has been removed. A wedge-shaped pad, then, should be pushed into the tooth cavity, and kept in position by binding the upper and lower jaws together as in 10, frontispiece. A lashing of string is attached to the plug to prevent its dropping down the throat when the patient is asleep, and choking him. The end of the string should be brought out of the corner of the mouth, made into a loop, and fastened round the ear.

Compression of the carotid artery in bleeding from a tooth cavity is useless, on account of the blood coming away from other arteries besides those affected by the compression.

Torsion, or the seizing of a spurting artery with a pair of forceps and twisting the end round and round, simulates what I previously told you as what occurs in railway accidents. This could only be performed by a surgeon.

Arteries may be ligatured, or the divided end tied and closed by this means. Silken thread and catgut are the ligatures usually used for this purpose, preference being given to the latter, because it becomes absorbed in the wound, like gelatine. In surgical operations, tying an artery is the general mode of arresting arterial bleeding, and the following definition given by a medical student of the manner in which an amputation is performed is a very good one. That "we saw through all the hards, cut through all the softs, and tie all the spurts."

LECTURE III.

Injuries to joints; Treatment of Sprains; Wounds; Foreign bodies in the eye and ear; The signs of Fracture, and first aid to be rendered in such accidents; The application of Splints, or other restraining apparatus.

THE first subject I purpose discussing is wounds and their treatment.

Wounds may be either—

1. Incised.
2. Punctured.
3. Lacerated.
4. Contused.

An incised wound is that made by a clean-cutting instrument, such as a knife, a sharp piece of glass, or razor, as in cases of cut throat, which, unfortunately, are very common.

A punctured wound is one where the depth of the wound exceeds the breadth, as in stabs and bayonet wounds.

Lacerated wounds are those occasioned by blunt instruments, and where the parts are torn, and the edges of the wound rendered irregular.

Contused wounds are those where the surface of the skin remains intact, but nevertheless accompanied by much bruising, and more or less injury to the subjacent parts. Buffer accidents on the railway are the most serious of this variety.

Gunshot wounds constitute a species of contused and lacerated wound combined.

Wounds are more or less serious according to whether they are deep or merely superficial. A deep wound stands the chance of having wounded some important sublying vessel or viscera, and the life of the patient is endangered accordingly. Such cases had better be left alone until the arrival of a surgeon.

A lacerated wound never heals as quickly as an incised one, and is more especially liable to be followed by erysipelas, &c. The edges of the wound being torn and jagged, suppuration must occur to get rid of this bruised tissue before a healthy healing surface is produced, whereas in an incised wound, the edges being cleanly cut, they unite together almost immediately, and by what is called "first intention."

From an incised wound one usually finds a greater amount of hæmorrhage than from a lacerated one, as in the former vessels are cleanly cut through, whilst in the latter they are torn and twisted in a similar manner to what was described in the operation of torsion.

The rules I will now give you are applicable to the treatment of all wounds of any variety or of any severity.

The first most important thing to do is to arrest any bleeding, whether it is venous or arterial in character, by those directions which were given you in the last lecture. This must, of course, take precedence of everything else, as until this is stopped, the patient's life is in danger.

In slight wounds, the elevation of the limb and the application of cold water are generally sufficient to arrest all bleeding.

Next remove all foreign bodies from out of the wound, examining the instrument which occasioned it, whether it be a knife, a piece of glass, or a needle, to see whether it is entire; if not, search for the broken fragment Sometimes gun-wad, or a piece of clothing covering the body is carried into the wound. This should be removed, as well as any dirt, occasioned perhaps by the passage of a cart-wheel over the limb, as the presence of any foreign body in the wound will hinder the process of healing.

The practice of sucking a wound is a very good one. In former duelling days "suckers," who were often the drummer boys of a regiment, were employed for this purpose. Sucking the wound till the blood ceased to flow removed all foreign bodies, and brought the edges of the wound close together, so that union took place very speedily.

Sponge the wounded part with the coldest water obtainable, letting a stream of cold water fall over the wound by squeezing a sponge held above it, and clean away all dried blood and dirt from round about it. When this is done, what in the first instance looked a very serious injury, may prove to be a very trifling one.

If it is a case of a punctured wound, not involving one of the great cavities of the body, and a syringe is available, syringe it out well with some cold water; but if a cavity is involved, and water is syringed into it, great harm will result, as the fluid will collect there, and it will be impossible to get it out again.

When the wound has been inflicted by an instrument which you believe to be foul, such as a knife that has been used for cutting up putrid meat or game, it is as well to apply a bread poultice to the wound, so as to assist in getting rid of any poisonous material that may be present.

Lastly, bring the edges of the wound in as close proximity to one another as possible, so as to aid them in uniting together again. This may be done by means of strapping, stiches, accurate bandaging, or painting with collodion.

A pad of lint saturated in water, or better still olive oil, is then placed over the wound, and bandaged in the appropriate manner to be hereafter described in the chapter on bandaging. Any piece of linen rag will do for a pad; but if lint is used, be careful to put the threadbare and not the fluffy side next the sore, as the small fibres of the lint cling to the wound, irritate it, and when removed cause the healing granulations to bleed.

If the part to which strapping is to be applied is hairy, the skin should be shaved all round the wound, so that the plaister may stick more readily, and also when removed, it will not occasion pain by dragging upon the hairs. When the wound is on the scalp, some compunction should be felt in sacrificing the hair, as bare patches look as if consequent upon other diseases. Wounds of the scalp, especially when strapping is not immediately procurable, may be brought into close apposition by taking a lock of hair on either side of the wound, and tying them together across it.

When strapping is applied to a wound it should not entirely cover it, but spaces should be left between the strips of plaister to allow of the escape of matter, or as we usually call it, pus, which comes away from the wound.

There is a proper way of taking off plaister as well as of putting it on. Both ends of the strip of plaister should be loosened, and brought to the wound, so that the whole is removed at one time, and then there is no fear of opening up the wound, or breaking down the very slender granulations which hold it together. A person who does not know how to remove a strip of plaister usually takes hold of it by one end only, tears it across the wound, and opens it up again by separating the edges.

There are some wounds which demand special treatment, and of these I will now speak.

Wounds of the face bleed more readily than other parts of the body, but the bleeding is usually easily controlled by the simple pressure of a pad and bandage.

Such wounds ought to be brought together as soon as possible, especially if there is any division of the upper or lower lip, so as to prevent any subsequent disfigurement. Therefore, stitches have generally to be put in, to keep the edges of the wound together. It is better that this should be done by a surgeon whenever possible; but if not, a fine sewing-needle, threaded with silken thread or a long piece of human hair, may be used for this purpose, tying the same across the wound with a reef knot. (Fig. X.)

A punctured wound in the palm of the hand is very frequently met with from attempts to open a nut with a knife, or to split a biscuit by the same unsailorlike fashion.

This is best treated by a pad or graduated compress, which should be about an inch in thickness, and consist of pieces of folded linen or paper placed one above another, gradually increasing in size, so as to form a wedge-shaped pad. The point of the wedge is placed in contact with the wound, and the base uppermost. This pad is then bound in position, either by winding a bandage folded narrow across a stick as shewn at (28, frontispiece), or by flexing the fingers upon the palm.

A tennis or cricket ball may in the same manner be placed in the palm of the hand, and the fingers closed over it.

If oozing of blood continues to come away from under the graduated compress, make a ruck of the sleeve in the flexure of the elbow joint, and then tightly bind the fore-arm and upper-arm together. The elevated position of the hand, and the compression of the brachial artery at the bend of the elbow, cannot possibly fail to stop the bleeding.

The same variety of wound occurring in the sole of the foot should be also treated by a graduated compress and bandage.

All wounds, especially of the hands or of the feet, as in sailors who run about on deck barefooted, should be kept covered up as long as there is any open or raw surface, because in cleaning copper or brass-work the wound might easily get poisoned, or some foreign body get into it, and subsequent poulticing have to be resorted to.

The remaining parts of the body are seldom exposed to punctured wounds, excepting, perhaps, the seat. A person may sit down upon an open knife, or a pair of scissors carried in a tail-coat pocket, a pointed needle, or a cracked utensil. These should all be treated by the means I have already described to you, viz., removal of any foreign body and arrest of hæmorrhage by direct pressure and bandaging.

One word as to the treatment of cases of cut throat, which come under the head of incised wounds. They differ from other wounds as regards treatment in one chief point, and that is, that no stitches or strapping are used in these cases.

The first thing to be done is to stop the bleeding, which is always profuse, and sometimes immediately fatal if the large blood-vessels in the neck are divided. This, happily, does not always occur, as many of these foolish people, believing themselves to be constructed after the fashion of bellows, think that if the windpipe is opened and the air let out, it will prove fatal.

Bleeding is controlled by direct pressure with the fingers in the wound, pressing backwards against the cervical vertebræ.

The edges of the wound are kept together by bringing the chin down on to the chest and keeping it there by means of a couple of tapes fastened one on either side of a head-cap, and attaching them by their other ends to a bandage going round the chest.

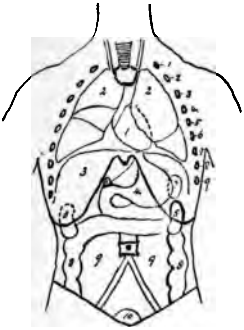
The reason why this way of bringing the edges together is adopted, is to allow of the wound being easily opened again if the breathing is in any way interrupted, and which could not be so quickly done if stitches have been used.

The opening into the windpipe should be protected by folds of muslin or gauze, to prevent the entry of cold air into the lungs, and the same held in position by a bandage simply passed twice round the neck as in (29), large diagram. The patient must be likewise kept in a warm and moist atmosphere by means of a bronchitis-kettle placed on the fire in the room. Ordinarily the air passing through the mouth is freed of all foreign bodies, moistened by the saliva, and warmed by its passage across the mucous membrane of the mouth and throat, and the above directions are carried out to supply these several deficiencies.

Penetrating wounds of the abdomen and thorax are especially serious, for fear of any of the contained viscera being injured. If such is the case, the wound should not be closed, but the patient left with the wound lightly covered over and the knees flexed, so as to relax the muscles forming the front wall of the abdomen, until medical help is obtained.

A knowledge of the relative position in the body of the several viscera is important, as it gives you some idea of the organ that is likely to be injured in penetrating wounds.

This knowledge is best obtained by means of a diagram, as in Fig. VI.



1. Heart.
2. Lungs.
3. Liver.
4. Stomach.
5. Kidneys.
6. Gall bladder.
7. Spleen.
8. Large intestine.
9. Position occupied by small intestine.
10. Bladder.

Fig. VI.

The above organs are subject to slight alteration as regards their position, according to whether they are full or empty. For instance, the stomach, when distended with food, would occupy a larger space than when empty, and consequently stand a far greater chance of being injured.

Again, the bladder is larger in the male than in the female, and, moreover, when full, would reach up as high as the navel, which is represented in the above diagram by a central spot.

Foreign bodies in the eye require to be taken out with some skill, the eyelids being turned inside-out while the whole of their inner surface can be thoroughly examined ; but as this requires some manual dexterity in the mode of operation, it is best done by a surgeon.

A pencil or darning-needle is placed flat on the upper eyelid, about half an inch above the eyelashes ; and whilst they are drawn upwards the needle is kept steadily pressed against the eyeball, and the patient told to look down.

The lower lid can be easily examined by being simply depressed. The inner surfaces of the eyelids can by the above means be thoroughly cleaned with the corner of a fine handkerchief or a camel's-hair brush.

Whenever any foreign body is present, remember to keep the eyelids closed and not to rub the eye.

The irritation set up will cause an increased flow of tears, which is the mode by which nature gets rid of any foreign body, and by means of which she is frequently successful.

Remember that the course of the tears is towards the nose, and therefore blowing that organ will draw the tears forcibly in that direction, and aid in the removal of the foreign body.

Cold water or cold tea applied by means of a small cup-shaped sponge are the best applications to subdue any subsequent inflammation.

Lime, mortar, or plaister in the eye, if seen directly after the accident, should be treated by syringing with weak vinegar and water; but if some time has elapsed after the injury, then apply simple olive oil.

Foreign bodies in the ear are also best left to medical help.

The external canal of the ear is about 1¼inch long, and stretched across the inner end of it is a delicate *membrane called* the drum of the ear. On the opposite side of the drum is another canal called the Eustachian tube, which opens into the mouth. This is the reason why so many people who are deaf sit with their mouths open, so that sounds may fall upon the inner surface of the drum as well as upon the outer.

Too forcible syringing, with the nozzle of the syringe so firmly pushed into the ear as to interfere with the outflow of the water, may break this membrane or drum.

A box on the ear, or heavy gun-firing will also do the same thing; and after the latter, one frequently experiences singing noises in the ear, similar to those heard when a sea-shell is placed against it. These noises may be lessened by keeping the mouth open, so that the vibrations of the air may be the same on both sides of the drum. Placing cotton wool firmly into the ear is of no use; if put in at all it should be put in very loosely, just at the orifice, to break any sudden vibration of sound.

Never syringe an ear if a pea, bean, or soft substance of any kind is in it, as the water will cause it to swell, and the chances of getting it out are much lessened.

Joints may be injured by blows or kicks, causing them to swell up, from an increased secretion of that fluid (synovial fluid) which I told you was present in the interior of all joints, to allow of their moving easily and freely (see Fig. II.) To this injury is given the name of synovitis.

Joints may be so severely injured that the ligamentous structures which bind the apposed bone surfaces together may be stretched, or even partially torn through. This is a still more severe variety of sprain.

You often hear a person say that a sprain is as bad as a broken bone, and so, in a good many instances, it is. It entails quite as long a period of rest; and after recovery necessitates care and support by means of elastic appliances, such as knee-cap or anklet.

Cold applications and perfect rest are the best treatment for a sprain. Cold may be applied either in the form of an evaporating lotion made out of Eau-de-Cologne and water, or any spirit and water, or what is better still is the application of an ice-bag, which can be speedily constructed by placing a lump of ice in a sponge-bag, sheep's bladder, or folded oil-silk, and placing it upon the swollen joint, and keeping it there by bandaging, as at 11 and 27, frontispiece.

Elastic support by knee-caps, or anklets, should always be adopted when any severe strain is going to be thrown upon the joints. This was done, as probably you are aware, by Gale, in his celebrated walking exploits.

Joints may be still more seriously injured, the opposed bone surfaces being thrown out of apposition, and the ligamentous structures binding them together more or less torn through. This is called a dislocation.

As regards the reduction of dislocation, I will say but little, as the sooner you obtain medical assistance the better; for the reason that the sooner a dislocated joint is attempted to be put back again into its place, the more likelihood is there of its being accomplished. If a long time elapses, the bone may never be got back again into its place, and deformity and loss of power be present for the remainder of life.

You may say, Then why may not we put the bone back again into its place? Because in some instances it is a very difficult thing to do, and, without great care is used, vessels and other important structures may be torn across, or, as in one case, the entire limb dragged off by undue violence used in an attempted reduction.

Before passing on to fractures, I will tell you how to distinguish a dislocation from a fracture.

In both cases there is a deformity; but whereas in fractures you find increased and unnatural movement in a limb, in dislocations you have a deficiency of movement in connection with some joint.

In a dislocation there may be shortening or lengthening of the limb, according to the position assumed by the displaced bone; whilst in fracture there is nearly always shortening, from the fragments overlapping one another. The great distinguishing sign is the presence of a grating noise or crepitus, and the seat of injury is generally in the shaft of the bone in cases of fracture, whilst in dislocations there is an absence of crepitus, and the seat of injury is always at a joint.

One piece of advice to you is that, no matter what the injury may be, whenever possible, compare the injured limb with the sound one on the opposite side of the body. You will by comparison see any irregularity in shape, or any deficiency, of movement, as well as any alteration in the length of the two limbs.

Bones may be broken, or as we usually call it, fractured. Fractures may occur from two causes, external violence or muscular action. External violence may be applied directly or indirectly. A kick from a horse fracturing the nasal bones is an example of a fracture by direct violence ; whilst a man thrown from his horse in the hunting field, falling upon his outstretched hand, and fracturing his collar-bone, is an example of a fracture by indirect violence.

Fracture by muscular action is best exemplified in a fracture of the knee-cap. A person coming downstairs, and fancying he has arrived at the bottom of the flight, is mistaken, and fearing that he may fall forwards suddenly draws himself back, and the strong muscles on the front of the thigh snap the knee-cap across, in a similar manner to the way you would snap any stick across your knee.

Age exercises considerable influence on the liability of bones to fracture. The bones of the aged are more brittle and earthy than the elastic and cartilaginous bones of young people, as I described to you in my first lecture. It has been known for an old person to break his thigh simply by turning over in bed; whilst on the other hand, in young children a bone may be bent and not absolutely broken across *as the result of* some accident. To this latter variety is given the name of green-stick fracture, from its resemblance to the manner in which any green bough can be bent out of the straight line.

Fractures are divided into two classes, simple or compound.

A simple fracture is when a bone is broken across in one place, and the skin covering the seat of fracture remains entire.

A compound fracture is one where the bone is broken across in one place, but there is a wound in the skin communicating with the broken bone. This wound may have been occasioned at the time of the injury, or secondarily by the broken bone piercing the skin.

If in either of these two classes the bone is broken in more than one place the injury is a comminuted one, either simple comminuted or compound comminuted.

The term "impacted" is sometimes given to a fracture. This occurs when the sharp pointed end of one fragment is impacted or driven into the interior of the other fragment.

Complicated fractures are also occasionally spoken of. In other words it is a fracture accompanied by some other serious complication; for instance, a fracture of the skull, complicated with injury to the brain or its membranes; the ribs complicated with injury to the lungs or pleura; and the pelvis with injury to the bladder or urinary tract.

A fracture may traverse a bone obliquely, transversely, or longitudinally, the first being the most frequent in long bones, whilst starring occurs usually in flat bones.

Now as to the signs of a fractured bone. In addition to the knowledge of some injury referred to some particular spot, and the pain incident thereon, there are three symptoms associated with all fractures, viz :—1. Deformity.
2. Unnatural movement.
3. Grating, or crepitus.

Deformity is produced by the irregularity caused by the broken bone, and the limb may be moreover shortened by the broken fragments overlapping and riding one over the other.

Unnatural movement in a limb can only occur in a case of fracture, and is caused by the separation of the fragments from one another, and the formation as it were of a false joint.

Grating of the roughened surfaces of the broken bone can be felt as well as heard on moving or slightly rotating the limb, and to this sensation is given the name of crepitus.

The immediate treatment of a fracture is to keep the limb at perfect rest, so that the patient may be removed to some permanent resting-place, where he can remain until a cure is effected, and the broken bone again united.

The importance of keeping the broken limb immovable cannot be too strongly impressed upon you; for any incautious movement might very easily send the sharp end of the broken bone through the skin, and a simple fracture be transformed into a compound one. This is a very serious matter, for instead of the sufferer being able to resume his work in about four weeks, it will entail rest probably for a corresponding number of months; and this to a labouring man would be a great loss.

"To set a fracture" is to place the two ends of the broken bone in close apposition to one another, and to keep them in that position sufficiently long for them to eventually unite. The great obstacle to this is occasioned by the contraction of the muscles inserted into the respective ends of the bone causing them to ride one over the other, or preventing them remaining in close proximity. In rare instances it has been found necessary to divide the muscles to rectify this, but generally by flexing the limb this can be accomplished without resorting to so severe a measure.

To *ensure* complete immobility of a broken bone, the joints above and below the fracture must be kept perfectly immovable, as movement of either joint would prevent this. Splints are therefore used to restrain all movement, and are usually padded ; but in rendering first aid the clothing which surrounds the limb is generally sufficient to answer this purpose.

The treatment then to be adopted in all cases of fracture is perfect rest, with the broken ends of the bone in close apposition.

Extemporised splints may be made of numerous things, such as walking-sticks, broomsticks, truncheons, umbrellas, folded newspapers, straw bottle cases, branches of trees, paper-knives, folded waistcoats, bayonets, scabbards, or rifles.

The splint, whatever it is made of, is bound in position by means of bandages. These bandages should never be placed over the seat of fracture, where there is always some swelling and inflammation, but by leaving the seat of injury uncovered, cold water dressings or ice can be applied to reduce the inflammation which is present.

After having put up a broken leg in the requisite splints, it is a very good plan to bind the injured limb to the sound one by another bandage or two. This gives an extra support in moving the patient.

I will now describe the different modes of applying splints to the more important fractures, and how you are to act until you can obtain medical assistance.

There are three fractures to which splints are never applied, viz., those of the skull, collar-bone, and ribs.

Fracture of the skull may be caused by a fall, or by a blow from some object.

It is usually accompanied by more or less prolonged insensibility, due either to concussion or compression, and consequently we shall have to speak about this later on under that heading. It is a very serious accident, on account of the subjacent brain or its coverings being liable to injury, or to subsequent *inflammation.*

More serious still is a fracture of the base of the skull. A person falling upon a hard substance, or a direct blow, will fracture the vault of the skull; whereas falling upon a soft or yielding substance, such as a man falling from a scaffold upon a heap of soft earth, the weight of the body would drive in the base of the skull, and fracture it. Accompanying profound insensibility, there is usually profuse bleeding from either the nose, mouth, or ear, and patches of blood underneath the conjunctiva of one eye, and oozing of watery (cerebro-spinal) fluid from the ear.

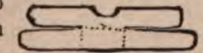
Let the patient be carried on a shutter with his head raised, to some quiet spot; apply cold water or ice to the head, and insist upon his being kept perfectly quiet until medical help arrives.

Fracture of the ribs has no splint applied, as it is impossible to obtain perfect immobility on account of the constant movement which takes place in respiration. This fracture is occasioned by blows or squeezing of the thorax, and is especially liable to be followed by secondary complications, such as inflammation of the lung or of the pleural membrane, either of which may have been injured at the time of the accident. By placing the hand over the seat of the injury, and asking the patient to cough, crepitus is easily felt. A bandage, folded broad and passed around the chest, is the only first aid that you can render in these cases.

Fracture of the lower jaw or inferior maxillary bone (10, frontispiece), may occur from blows or falls upon the chin. The mouth is closed, with inability to move it, and not widely open, as in cases of dislocation.

The line of the teeth is irregular, as well as the external outline of the jaw.

It requires two bandages, both folded very narrow, and a splint, made after this pattern out of a cardboard or an old book cover.



The lower half bent backwards, corresponding to the dotted lines, will form a cap for the point of the chin; the concavity in the upper half being cut away for the mouth. One bandage is placed below the chin and knotted at the top of the head, whilst the other, placed with its centre on the chin, is carried to the back of the head, crossed and then brought round on to the forehead and tied there. The ears are not to be covered over, but left in the centre of the triangle formed by the bandages at the side of the head. All four ends of the bandages may be subsequently tied together or not. There is a greater chance of fixing the lower to the upper jaw by this means than by a simple bandage passed below the chin and fastened on the top of the head.

Fracture of the collar-bone or clavicle (33, frontispiece), is occasioned usually by falls on the outstretched hand. The shoulder drops, the arm hangs helpless, and the patient supports his elbow with the opposite hand. A large wedge-shaped pad should be put in the armpit on the injured side, with the broad part of the pad uppermost, and this is kept in position by a bandage passed in a figure of 8 form over each shoulder, crossing itself in the centre of the back. Another bandage is passed around the arm of the injured side, holding it by a turn of the bandage around the wrist in a semiflexed position, and thus binding it to the body, to restrain movement as much as possible. If the patient is very broad shouldered, two bandages must be used, to make this form of figure of 8, and to keep the shoulders well back.

Fracture of the upper arm or humerus (2, frontispiece) occurs from direct blows or falls upon the elbow. Three splints should be put on the front, outer and back part of the limb, and reach from the shoulder to the elbow joint. The inner side is omitted, so that the blood-vessels lying on that side may not be compressed. The splints are bound in position by two bandages folded narrow, and the arm *being semiflexed*, the forearm is supported by a small arm-sling. (24, frontispiece). A large arm-sling pushes the elbow too much upwards.

On your handkerchief bandage this fracture is represented as being done up with the elbow joint extended, a most unusual and uncomfortable position; whereas, in the semiflexed position, it is comfortably supported in a sling. The arm would only be done up in an extended position in cases of burn, where there might be a fear of subsequent contraction from scars.

An expanding trellis flower-pot cover forms an excellent splint for this, as well as for other fractures of the limbs, and is exceptionally well adapted for this injury, but if put on too tightly, will arrest the flow of blood in the main (brachial) artery.

When the fracture is at the lower end of the humerus, and perhaps combined with some injury to the bones of the fore-arm, a rectangular splint should be applied to the inner side of the elbow-joint, with the arm in a semiflexed position. Two pieces of wood can be lashed together by a bandage wound round them where they cross one another, and a rectangular splint easily constructed. Outside splints must be applied as well.

Fracture of the fore-arm or radius and ulna (12, frontispiece), occurs usually from falls. The arm should be placed in a semiflexed position, and two splints are required. The splint on the inner side should extend from the elbow to the tips of the fingers, and the outer one from the elbow to the wrist joint. Two bandages folded narrow keep the splints in position, and the arm is subsequently supported with a large arm-sling (4, frontispiece.)

Fractures of the fingers, or phalanges, are caused by direct violence. They require a long narrow splint, which should extend from a little above the wrist to the tip of the injured finger, applied to its palmar surface. A long paper-knife answers the purpose admirably. The hand should be subsequently supported in a large or small arm-sling—(4, 24, frontispiece). Another very comfortable plan of treating this injury is, to flex the fingers over a cricket ball and bind them there.

Fractures of the thigh bone or femur (16, frontispiece)—(there are on your Esmarch handkerchief two 16's; I refer to the man lying down in the right-hand corner) occur from falls, and in the aged from the most trifling causes. It requires two splints: the one on the outer side should be a very long one, and extend from the armpit to the sole of the foot, whilst the shorter one is placed on the inner side of the thigh, and should reach from the fork to a little below the knee joint. Four bandages, folded broad, are required. One is applied in a figure of 8 form around the sole of the foot and ankle-joint; taking in at the same time the lower end of the splint, the bandage crosses itself on the instep. A second bandage should be placed below the seat of fracture and just above the knee-joint, and the third above the seat of fracture as close to the hip-joint as possible. The fourth bandage is applied round the abdomen, to keep the upper end of the splint in close proximity to the body.

Remember what I previously told you in putting up any fracture, to restrain all movement of the joints above and below the seat of injury, and then you are quite certain of keeping the fractured part immovable. Therefore, you see that on the Esmarch handkerchief for a case of fractured femur the second bandage is wrongly represented by being placed below the knee-joint, whereas it ought to be abóve it, to prevent any movement in the lower end of the broken bone.

Fracture of the kneecap or patella (14, frontispiece), occurs usually from muscular action, and occasionally by direct blows. A broad splint should be applied to the back of the knee-joint, extending some eight inches above and below it. Two bandages, folded narrow, are required; the first is placed with its centre below the knee-cap, carried to the back of the joint, crossed behind the splint, and brought above the *knee-cap and* tied in a knot. The second bandage is put on in a similar figure of 8 manner, but is placed first above the knee-cap, then crossed behind the splint, and knotted below the knee-cap. The broken fragments, generally very widely separated, are by this means, assisted by elevation of the limb, brought close together. The front of the joint is left uncovered, so that cold applications or an ice-bag can be applied to the swelling, which is always considerable.

Fracture of the leg bones or tibia and fibula (1, frontispiece) is occasioned usually by direct violence, but sometimes by a sudden twist of the ankle. Two splints are required of the same length, to extend from just above the knee-joint to the sole of the foot. One is placed on the inner and one on the outer side of the limb, and bandaged in position by two bandages. One bandage is passed in a figure of 8 form around the sole of the foot and ankle-joint; taking in at the same time the two splints, the bandage crosses itself on the instep. The other bandage is applied just below the knee-joint; thus all movement from above and below is prevented.

When the fibula alone is broken, the tibia forms a splint for it, and consequently, patients are able to walk with this injury, and have been known to do so. Splints should be applied in the same manner as if both bones were broken.

Fractures about the foot are always caused by direct violence. They require a special form of splint, made rectangular, into which the heel fits; the sole of the foot resting against one support, and the calf of the leg against the other. The first aid consists in elevating the foot and applying cold water.

LECTURE IV.

First aid to those suffering collapse from injury, to those stunned, to the apoplectic, inebriated, epileptic, hysterical, fainting, and to those bitten by rabid animals or stung by insects.

The immediate treatment of the apparently drowned or otherwise suffocated.

Burns, scalds, and poisons.

COLLAPSE from injury is the severe shock given to the nervous system by any serious accident that may have taken place. For instance, a patient may never recover from a severe operation, on account of the shock to the system; and formerly, before the days of chloroform, this was far more frequent than it is at the present time. Again, in a patient who has had his limb smashed and subsequently has to undergo amputation, the amount of shock is increased by the twofold effect, viz., firstly, by the accident, and secondly, by the amputation; and the nearer to the trunk that an amputation is performed, the greater is the amount of shock. For instance, an amputation at the shoulder-joint is attended with a greater amount than one at the elbow.

Collapse, or shock, as it is more often called, varies in degree in different individuals. Females, children, and persons of great nervous susceptibility, show an extreme degree on the receipt of but a trivial injury; whilst on the other hand, men in a state of great excitement, such as soldiers upon the battle-field, with their feelings roused to the highest pitch of enthusiasm, may receive some very severe injury, and yet be almost unconscious of it.

A person suffering from shock after the receipt of *some injury* becomes cold and trembling. The pulse *is irregular* and hardly to be felt. The surface of the body is cold and clammy, the mind depressed, and the patient is anxious and restless, thinking perhaps every moment will be his last.

Should such a case come under your notice, what are you to do? If the origin of the shock is a crushed limb or any injury attended with profuse hæmorrhage, you must not accelerate the circulation by giving stimulants until you have prevented all further loss of blood; because you would, by so doing, accelerate the patient's death. This having been guarded against, the administration of some warm tea or spirits and water may be given if the patient can swallow, or if not, some ammonia applied to the nostrils will stimulate the heart's action. The giving of fluids when the patient is unconscious and unable to swallow will result in sending some of it into the larynx, and cause choking.

The patient should be laid in a recumbent posture, wrapt up in warm blankets, and have hot-water bottles applied to the feet.

This is the treatment of shock, whether arising from severe injury, operation, fright, or any other cause.

We will now pass on to the consideration of the different causes of insensibility, whether stunned, apoplectic, epileptic, or faint, and how to decide that important question, "Drunk or Dying?" as we frequently see these cases styled in the newspapers.

They are extremely difficult of recognition, and when —not unfrequently—doctors make mistakes in their diagnosis, no one should blame you, or policemen either, for being occasionally in the wrong.

But what I wish to impress upon you is to err on the right side, and that is the side of caution. For it is far better in all cases to give the patient the benefit of the doubt, and to treat a drunken man with more indulgence, perhaps, than he deserves, than to treat another man with a fractured skull, but whose breath may nevertheless smell of liquor, as being simply drunk and fit only to be locked up.

Treat all cases of insensibility, then, with extreme care, and get professional advice as soon as you possibly can.

During my residence as House Surgeon at St. Thomas's Hospital, I never refused admission to any case of complete insensibility, because a night's lodgings in a hospital is, in the eyes of the general public, a far better resting-place than a police-cell; and if the case turn out in the morning to have been only one of drunkenness, you can discharge your patient with a caution, and with the knowledge that you have acted for the best.

Insensibility may be due to six causes.

1. Injury to the brain, with or without fracture of the skull.
2. Diseases of the brain, as apoplexy, epilepsy, &c.
3. Narcotic poisoning, as from opium, morphia, &c.
4. Intoxication.
5. Blood poisoning from kidney disease.
6. Extreme shock from failure of the heart's action or excessive hæmorrhage.

To distinguish the cause of the insensibility is of the greatest importance, as the treatment to be adopted will vary accordingly. I will take, therefore, each of these causes separately, so that you may be able to tell one from another.

1. Injuries to the brain, with or without fracture of the skull, sufficient to produce insensibility, may be due either to concussion or to compression.

Concussion, or bruising of the brain substance, may be caused by blows or falls on the head. The duration of the insensibility corresponds with the extent of the bruising, in some instances lasting a very short time, in others several hours.

The pupils of the eyes are generally contracted, the pulse is feeble, the breathing slow and sighing, and the surface of the body cold and pale. Vomiting precedes returning consciousness, and there is no *paralysis.*

Recovery may be complete if rest and care are taken, with the application of cold to the head and warmth to the extremities; but no injury to the brain is too trivial to be thought lightly of, for fear of subsequent inflammation and brain softening. The same applies to concussion of the spinal cord; and if proper rest was taken also in these cases in the first instance, we should hear less of railway litigation.

Compression may be the result of blood or a portion of bone pressing upon the brain.

The symptoms are the same as those of apoplexy, of which it is a traumatic variety.

General paralysis or paralysis of one side of the body, opposite to that of the seat of compression—as explained to you when speaking of the function of the nervous system, with stertorous breathing, and inequality of the pupils, which do not act under the influence of light,—are the chief symptoms present, just as in apoplexy, and the treatment is identical.

2. Diseases of the brain, as apoplexy and epilepsy. —Apoplexy is by far the more serious of the two, and both are attended by a fit. By a fit I mean convulsions and contortions of the limbs and trunk, with congested face and foaming at the mouth.

Apoplexy caused by effusion of blood pressing upon the brain is attended with more or less paralysis of the body, snoring or stertorous breathing, one eye half opened, with the pupils unequal in size, and the pulse full and quick. If the patient is not quite insensible, he is rambling and incoherent in his speech. Place him flat upon his back, with the head raised, and loosen everything about the neck. Apply cold or ice to the head, and act upon the bowels by means of a purgative, or by an enema if unable to swallow. The feather part of a quill pen dipped in croton oil, so as to take up only one drop, and wiped across the back of the tongue is the best way of giving an aperient in these cases.

In epilepsy the fit is sometimes preceded by a sharp sudden cry, but which is not continuous, as in hysteria. The convulsions are more marked than in apoplexy and so violent at times that the tongue being jerked out of the mouth may be bitten by the sudden closure of the jaw, and as a consequence blood will then be mixed with the foam about the mouth. The eyes are staring or squinting, with the pupils equal in size, but which do not act under the influence of light. Insensibility is complete, and after the fit the patient falls into a heavy sleep.

Amongst soldiers the fits are often brought on by gorging the stomach with beer, and an emetic would then be the best treatment.

The most important thing to do during the fit is to prevent the patient injuring himself, to put a pad of linen between the teeth, get him into the fresh air, and loosen everything about the neck.

Be on your guard, however, about being taken in; for at one time there was a man going about London, having epileptic fits, with the object of obtaining money from sympathetic onlookers. It is related of one, where the crowd had kindly placed some straw on the ground for fear of the man injuring himself, that a doctor came up, and fancying the man was shamming said, in his hearing, that one of the chief signs of an epileptic fit was, that at a certain stage the patient would turn on his left side and scratch his right ear. The man, of course wishing to do the thing properly, carried out this suggestion, which, I need hardly tell you, is not a symptom of epilepsy. So the doctor quietly set fire to the straw on which the man was lying, and he very speedily recovered and ran away.

Shamming epileptic fits is more frequently met with in the army and navy, when men are desirous of getting invalided from either service.

Putting gin or snuff into the eyes, or pressing the thumbnail with force under that of the patient,—an experiment productive of excruciating and harmless *pain, are means* for the detection of impostors.

There are three other diseases to which the name of "fit" is given, although not necessarily accompanied by convulsions. I allude to fainting, hysterical, and ague fits.

Fainting fits occur from weakness or mental shock. The face is pale, the lips livid, and the pulse and respiration almost imperceptible. The patient is quite insensible, and to all appearance dead. The very worst case of this kind I ever saw was in a young man who had come out of the water at a swimming bath, and was sitting propped up in his dressing box, and nobody had had the wisdom to lay him down on the ground.

The cause of the loss of consciousness is a deficiency of blood in the brain, and this is rectified by lying the patient full length upon his back and elevating his legs. In the seats of a theatre, or in a pew at church, where it is impossible to do this, or to get the patient out into the fresh air immediately, the same effect may be produced by placing your hand at the back of the patient's head and pressing it downwards between his knees. This will cause the blood to fly to the head, as you know when after stooping for some little time.

Stimulants are perfectly justifiable in these cases; and if the patient is unconscious, moisten the lips with your finger dipped previously in brandy.

When there is, as in some patients weakened by long suffering, a deficiency of blood in the body, what blood there is there must be kept for the use of the brain and heart, and consequently flannel roller bandages applied to the limbs will allow of a larger supply being available for those parts which most need it.

Hysterical fits are much more common, and they are of all fits those you are most likely to meet with. They partake somewhat more of the character of a fit, as the legs and arms are often thrown wildly about, with beating of the breast. They almost invariably occur in females and in convenient situations, with the object of getting up a scene. The face is flushed, and the veins of the neck distended. Insensibility is apparent, but not real. The eyelids are closed with occasional furtive glances. A very frequent and sure sign of hysteria is loud and continuous screaming.

Throw a bucketful of cold water over the face and neck, sufficient to make the patient very uncomfortable, and the rapidity of the return to convalescence is very remarkable. We always find with a patient in hospital, that if they ever do have an hysterical fit, they never have a second, which says much for the efficacy of the above treatment.

An ague fit is a very unlikely one for you to come across, and I should not have mentioned it had not I, only a short time ago in Oxford Street, seen a crowd collected round a man, and on going up to the policeman, he told me he had "diagnosed the man was not drunk." He happened to be a pupil of a former ambulance class held at Albany Street station. The patient was cold and shaking with the effects of a shivering fit, but not convulsed. He was perfectly sensible, and when asked, told me that he was subject to them.

A quinine pill from a neighbouring chemist, and wrapping the patient up warmly, are the best remedies to adopt.

3. Narcotic poisoning, whether by opium, morphia, or hydrate of chloral, I shall have to speak of later on under the head of poisons.

The chief signs are a contracted state of both pupils, and a lethargic condition going on to one of complete stupor.

4. Intoxication I need hardly describe to you. The odour of the liquor in the breath is the chief symptom to go by, and hence the liability to be mistaken, for it is quite possible for a person to have been drinking and to be immediately afterwards seized *with an epileptic* or other form of fit. Therefore be

very careful before coming to a conclusion that it is only a case of intoxication.

The insensibility of drunkenness may merge from jovial stupidity on the one hand to complete helplessness and stupor on the other. The pupils of the eye are of equal size, largely dilated, and act under the influence of light. The breathing is not stertorous.

Vomiting in these cases always assists a return to consciousness, and therefore emetics should be given.

Intoxication is virtually a case of poisoning, and the same treatment by emetics or stomach pump is applicable. In some cases the galvanic battery has to be used, whilst in others, nothing will prevent their having a fatal termination.

5. In cases of insensibility from advanced kidney disease, the symptoms are even more obscure; but the chances of your meeting with one of these cases is very small. The person is generally advanced in years, and bloated in appearance. The breath has the characteristic smell of urine, and there are present other signs of dropsy, such as swelling and puffiness of the limbs. Removal to the nearest hospital as speedily as possible is the best thing to be done in these cases, or otherwise wrap the patient up in warm blankets and give purgatives.

6. Insensibility from shock I have already described when speaking of collapse from injury.

Upon finding a person insensible, first of all feel the pulse to see if the heart still beats, and observe whether respiration continues. If both are present, notice if the former is strong or weak, and whether the latter is sighing, natural, or snoring.

Next examine the head, and search for any swelling or open wound, and if the latter is present, place the tip of the finger in it, and feel if the skull is fractured or not. Examine the ears and nostrils to see if any blood is coming away from them.

Examine the pupils of the eyes to see if they are contracted, dilated, or unequal in size, and also whether they get smaller on raising either eyelid.

Note the state of the mouth, whether froth or blood is present anywhere about it, and notice whether the patient has vomited or not.

Smell the character of the odour of the breath or vomit. Compare the two sides of the body, whether both move, or whether one lies helpless and motionless

Lay the patient upon his back, loosen everything about the neck and chest, and prevent the crowd from closing in around him.

Abstain, and prevent others, from giving brandy or other stimulant until you know the cause of the insensibility, and then act according to those directions that have been given you under the respective headings.

Bites of rabid animals are greatly feared on account of subsequent hydrophobia. This disease is usually seen in dogs, but it may also occur in cats, the male sex being more liable to it than the female.

The almost invariably fatal character of the disease when once developed, and which may appear from six weeks to many months after the injury, necessitates that all bites from animals should be treated with precautionary measures. Less fear need be felt when the bite is through the clothing, as then the poison may be wiped off by the clothes.

The treatment of these cases is identical with that which should be adopted in snake bites, which are occasionally met with, some fatal cases having occurred at the Zoological Gardens amongst the keepers of the snake house.

The chief points in the treatment are, to prevent the entry of the poison into the system, and to counteract the depressing influence if this has already taken place. You can, if you like, emulate the historic example set you by the wife of King Edward I., who is said to have saved the life of her husband by sucking the poison out of his wound. This, of *course, may* be very praiseworthy towards one to whom you are deeply attached, but not altogether agreeable towards a comparative stranger.

The entry of the poison into the system (by the veins conveying the poisoned blood to the heart) should be prevented by tying a handkerchief tightly around the limb between the bite and the heart, to prevent the return of the blood to that organ. The wound should be well scarified with a knife, cauterized, or well rubbed with caustic. Youatt, in his very excellent book on the dog, states that he has repeatedly inoculated himself with the poison from mad dogs, and subsequently cauterizing the wound, had no after ill effects. This is, I consider, conclusive evidence of the efficacy of the treatment.

To counteract the extreme prostration which ensues the free use of stimulants, such as brandy and ammonia should be resorted to.

Stings of insects are trivial, but at times extremely painful. The sting of a wasp or bee may be extracted by pressure, using the hole of a key for the purpose.

In gnat and mosquito bites the suffering may be materially lessened by the application of sal volatile.

Having been once very severely stung about the face and head by bees, I can strongly recommend the application of a thick coating of honey over the whole of the bitten surface, which immediately relieves the pain. Those persons who keep bees know that the chief thing to do is to exclude the air, and mould mixed with water is always ready to hand. Collodion or flour may be also used, or, as in Shakspeare,—

> "Fetch some flax and whites of eggs, to apply to his face."

The immediate treatment of the apparently drowned, or otherwise suffocated, is a subject of very great importance. So many spend their leisure hours upon the water, either in rowing, sailing, or skating, beside those who have their business upon the waters, that accidents in this element are remarkably frequent

To these occasioning causes must be added accidents occurring whilst bathing, and those cases of suffocation arising from noxious gases; for instance, chloroform, charcoal fumes, &c.

Suffocation by coal damp, or any other noxious gas, is to be treated by removing the patient into fresh air as soon as possible: loosening everything about the neck, dash cold water in the face, flick the chest sharply over the region of the heart with the wetted corner of a towel, and commence artificial respiration, which is presently to be described, at once. The same treatment applies to persons who have hung themselves.

The time that a body can remain in the water, and subsequent artificial respiration prove of use, varies. If the patient, on immersion, struggles, and draws at every inspiration water and air into the lungs, the two are churned up into a froth, and the chances of success are diminished; but if on the other hand the patient becomes insensible from fright or shock, the opening into the lungs is closed, no water is drawn in, and the chances of bringing the patient to life are much greater.

In suffocation from noxious gases the chances are even still greater, as the temperature of the body is not lowered by immersion in water.

Persons who fall into the Docks, so some of my ambulance pupils there told me, seldom recover, and this, they think—and very probably it is so—to be due to the water being impregnated with copper from off the bottoms of the ships.

At all events, in all cases persevere with artificial respiration for one or two hours, or until a medical man tells you it is of no avail.

In removing a body from the water, allow the head to be on a slightly lower level, so that the water in the lungs may drain away from the mouth; and it is to effect the same object that, previous to artificial respiration being performed, the coat and waistcoat *of the patient* are taken off, rolled up, and put under the lower part of the chest, so that the water in the lungs may gravitate to the mouth.

Send off at once for medical help, warm dry clothing, and hot bricks, or hot-water bottles (any wine bottle, filled with hot water, will answer this purpose), whilst you yourself immediately commence artificial respiration.

The damp clothes should be removed, and dry ones substituted; and the hot-water bottles or bricks, wrapped round with flannel, should be placed close to the limbs and trunk.

Prevent persons crowding round the patient, undo the braces or stays, and loosen everything about the neck, chest, and abdomen, so that when you perform artificial respiration, the air can enter freely into the lungs.

Clear the mouth and the back of the throat of all weed, dirt, &c., and the tongue (being paralysed, and likely to drop back, and prevent the air passing into the lungs) must be drawn forwards, and held out of the mouth by the fingers, covered with a pocket handkerchief. The reason for holding the tongue with the fingers protected in this way is not on account of delicacy, but the saliva makes the tongue so slippery, that it will easily slip out of your grasp; and as it is difficult to catch hold of, when once held it does not do to let it slip away again.

An india-rubber letter-band might be used to keep the tongue forward, passing it over the tongue, and under the lower jaw; but ten chances to one if you had it in your pocket at the time you wanted it—and the previous method is the bettter.

Artificial respiration performed thirteen to fifteen times in the minute is to imitate natural breathing; the ordinary processes of expiration and inspiration taking place with the same frequency.

There are two methods of carrying this out, known by the names of Dr. Marshall Hall's, and Dr. Silvester's. There is something to be said in favour of both, and the former is sometimes tried first of all, and followed up by the latter.

In Dr. Marshall Hall's plan, the dependent position of the mouth is greatly in favour of fluid running away, but it requires three people to accomplish it properly; whereas Dr. Silvester's method can be performed by one person, and is much easier and safer.

In Dr. Marshall Hall's plan the patient is laid upon his face, with one arm flexed and placed as a cushion for his forehead to rest upon. The opposite arm is then taken by the wrist with one hand, whilst the other hand rests on the patient's shoulder-blade of the same side. The body is then turned on its side, and a little beyond, and the arm which is being held by the wrist elevated above the head: by this means inspiration is effected. The body is then turned back on to its face, whilst pressure is made with the hand resting on the thorax sufficient to drive the air out again, and expiration simulated. Two assistants, one taking the head and the other the lower extremities, follow the operator in his movements when turning the body backwards and forwards.

In Dr. Silvester's method the patient is put upon his back, or better still on an inclined plane, with the feet raised. The operator goes to the head of the patient, and kneeling down or not, grasps the arms just above the wrists, then draws them gently upwards in an extended position, until they nearly meet above the head, thus dragging upon the breast muscles, elevating the ribs, and simulating inspiration. The arms are kept in that position for two seconds, and then they are brought down upon the chest in a flexed position, and whilst pressure is made with the wrists upon the front of the chest, the elbows are turned inwards, and pressed against the sides of the chest, and thus the air is squeezed out, and expiration effected.

If the arms are held, as is sometimes suggested, *above the elbows*, the arms being in a paralysed and helpless condition, they would flap wildly about when artificial respiration was being performed.

Expiration may be assisted during the performance of artificial respiration by applying ammonia, burnt feathers, or snuff to the nostrils; also by rubbing the chest and face briskly, and by dashing hot and cold water alternately on them. If a warm bath is procurable, the patient may be placed in it whilst artificial respiration is being carried on, as this supplies all the requirements of warm external applications; but it had better only be done under medical supervision.

When breathing begins to recommence, which it does by a few deep sighs—and a more pleasing sight to those who have been employed it is impossible to conceive—the patient's limbs and trunk may be rubbed, to produce as much warmth in them as possible.

The rubbing of the limbs should be upwards, so as to assist in the return of the venous blood to the heart; and the friction should be applied with a worsted glove or a piece of flannel, but not with the rough hand on the bare skin, for fear of chafing it.

When the patient is sensible and can swallow—and not before, for fear of adding still more to the fluid in the lungs,—some warm tea, coffee, or brandy-and-water may be given.

The patient, wrapped in flannel, should then be put to bed, and a mustard plaister applied to his chest.

Burns and scalds are amongst the commonest of accidents. The upsetting of boiling water or fat, the bursting of boilers, and the results of poor children drinking from kettles boiling upon the hob, are all of daily occurrence.

Scalds differ from burns only in intensity; the former consisting usually only of a reddening of the skin, with the formation of blisters, whilst the latter varies from a simple reddening of the skin to a blackened, charred mass. Scalds, however occasioned, by hot fat or oil, on account of their adhering more closely to the skin than water, are always more severe.

There are six degrees of burns. 1st, simple reddening of the skin; 2nd, with formation of blisters; 3rd, destruction of cuticle; 4th, destruction of the entire skin, with formation of sloughs; 5th, sloughs involve muscle and deeper structures; 6th, the whole thickness of the limb is destroyed.

According to the severity of the burn or scald, so will you have a greater or less amount of shock.

The amount does not, as you would suppose, depend upon the depth of the injury, as a man may have his entire foot charred and burnt off and not suffer so much shock as the man who has simple reddening of the whole surface of the chest and face.

But the greater extent of surface implicated the greater amount of shock; and this is to be treated by the directions I previously gave you under that heading.

As regards the treatment of the burnt surface: Remove very carefully the clothing—not dragging it off, but removing it piecemeal, and, if necessary, sacrificing it. Have ready to apply directly any portion is uncovered, a mixture of olive oil and whiting or Carron oil (which is a mixture of equal parts of linseed oil and lime water), upon strips of rag; and subsequently cover the oiled dressings with a thick layer of cotton wool, with the object of excluding the air as much as possible.

If the burn is in the neighbourhood of a joint, a splint should be put on, with the limb in an extended position, to prevent contracting scars, which would limit subsequent movement. When several fingers are flayed, each finger should be bound up separately, or they may subsequently adhere together and your patient be web-handed.

Remember, if the accident occur in the kitchen, where they most frequently do, the presence of the flour in the dredger on the mantelpiece, and which, *with the oil* or hot fat already on the wound, will make *an excellent* paste for excluding the air, without running *about to get* further applications.

In scalds of the mouth get medical help as soon as you possibly can, as these cases may speedily terminate fatally, from obstruction to the breathing. Oil or milk given to the child to hold in the mouth, and hot sponges applied externally to the throat, will greatly relieve the pain until a doctor arrives.

Blisters, whether arising from burns or from rowing, &c., should be pricked, the fluid allowed to escape, and the raised cuticle bound again in position.

Poisons are substances which, if taken in excessive quantity, are capable of causing death.

They are of different kinds, and to know the treatment to be adopted and the antidote to be employed, it is necessary to know what the poison is that has been taken. Therefore, be careful to save any remains that may be present in the cup or bottle, and which, by its appearance or smell, may be able to give you some clue as to its composition; and save also any vomit, should such a favourable result as vomiting have taken place.

Poisons may be taken accidentally or intentionally. When accidentally, they are usually occasioned by mistaking an external application for some internal medicine, or from eating some poisonous vegetable.

It would not be out of place here, if I gave you a caution never to have medicine bottles or chests in your bedroom. You may get out of bed in the middle of the night, and in the hurry of the moment take the contents of one bottle instead of that of another, with very serious results. If you had to go downstairs to get the medicine, you would probably not go for it at all, and be just as well without it.

Poisons, when taken intentionally, are generally those productive of the least suffering, although fashion which influences all things, affects also the choice of poisons, with the above reservation; and therefore, narcotics being the least painful, are the favourite ones to persons suicidally inclined. Poisons are divided into three *classes*—narcotics, narcotico-irritants, and irritants.

Narcotics are opium, morphia, chloroform, and hydrate of chloral.

Narcotico-irritants, a class intermediate between the other two, comprise strychnine, poisonous mushrooms, and belladonna.

Irritant poisons include the mineral acids,—carbolic acid, calomel, antimony, phosphorus rat poison, and arsenic.

The symptoms of narcotic poisoning are drowsiness going on to stupor and complete insensibility, with death. The patient, heavy with sleep and desirous of giving way to it, is roused with difficulty and pain; and the pupils of the eye are contracted to a pin's point.

An emetic should be given immediately, and a doctor sent for, to bring a stomach pump. The patient must be kept continually moving about; throw cold water in his face, administer strong coffee, apply the galvanic battery, and adopt every means in your power of keeping him awake. If insensibility become more marked, artificial respiration must be adopted.

Some persons defeat their suicidal intent by taking too large a quantity of the poison; the excess occasioning vomiting of the whole. Such a result is most desirable, and vomiting should be assisted by every means in your power. Mustard and tepid water, salt and water, or tickling the back of the throat with the finger or a feather will all assist in attaining this object.

Sulphate of zinc in 20 to 30 grain doses, or a couple of table-spoonfuls of ipecacuanha wine in water, are the emetics usually administered by surgeons. Irritant poisons produce intense inflammation of the mucous membrane lining the mouth, throat, or stomach, and in some cases completely destroy the tissues with which they come in contact.

They produce pain and cramps in the stomach, with purging and great nervous depression. Olive or castor oil, milk or raw eggs, should be administered in these cases, to protect the gullet and walls of the stomach.

If the patient has swallowed some mineral acid or caustic alkali, remember that acids and alkalies form antidotes to each other. Therefore, bear in mind that in poisoning by acids you give alkalies, such as soda, potash, magnesia, or even the plaster or scrapings from the ceiling, diluted with water; whilst in poisoning by alkalies you give acids, such as vinegar, orange, lemon, or limejuice-and-water.

Other antidotes I will not trouble you with, as the sooner you get medical help, and the stomach-pump used, the better.

But in poisoning by irritants never attempt to pass a stomach-pump. The mouth and gullet in these cases being already much inflamed by the action of the irritant, would be much more injured by any such attempt. In fact, my advice to you is, never on any account attempt to pass a stomach-pump yourself

I know it is suggested in some books that you should get the patient to swallow a yard of flexible indiarubber tubing, and then to raise the free end and pour, by means of a funnel, about a pint of lukewarm water into the stomach; and then, by lowering the end, allow the water to run out again like a syphon. This is to be done several times, and the stomach thoroughly washed out.

Well, this is all very pretty in theory, but quite a different thing in practice. If you think it an easy matter, try and swallow a yard of indiarubber tubing yourself. I have had to pass a stomach-pump a good many times, and I can tell you it is not such an easy matter as you may think, especially if the patient offers any resistance and a gag has to be put into the mouth, to keep it open. And yet it is suggested that you should use a flexible tube, when the tube of an ordinary stomach-pump is almost a stiff one. I am quite sure of this, that you would have very great difficulty in getting it into the stomach, if you ever got it there at all; and, more likely than not, after you had passed it a certain distance it would turn upon itself, and the end come back and look you in the face at your stupidity for supposing you could do anything of the kind.

LECTURE V. *(for Males only.)*

The improvised methods of lifting and carrying the sick or injured.

Methods of lifting and carrying the sick or injured on stretchers.

The conveyance of such by rail or in country carts.

THE different methods of lifting and carrying the sick or injured vary according to the number of persons available for the purpose.

Firstly, when only one person is available.

A very young child (sensible or insensible) can be easily carried in an extended position by the bearer placing one of his arms under the child's shoulder-blades, and the other arm below the buttocks. With people of larger growth this is, of course, impossible.

When the injury is to the foot or parts below the knee, the patient may, if of light weight, be conveyed pick-a-back; but this would be impracticable if the injury were in the upper part of the leg, because of the pain it would necessarily entail.

If the patient is suffering from some injury to the upper part of the leg, is unable to walk and yet perfectly sensible, he may be greatly assisted by the bearer placing his hip against the patient's hip on the uninjured side, and taking the arm of the same side and placing it around his own neck, and holding it there with one hand, whilst his other hand and arm encircles the patient's waist. Then by a series of hops the patient can be quickly moved along, and the injured limb kept well off the ground.

But the most important method is, how to carry, unaided, an insensible person.

The one that is most frequently used is the following, and is the one adopted by firemen, to whom I am indebted for the following information obtained when examining a very good class at the head-quarters at Southwark.

The insensible person is put flat on his face, with his arms extended in a line with his body, and then brought into a kneeling position. The bearer places his right shoulder against the centre of the body, whilst he places his right arm between the legs and around the right thigh; at the same time he seizes the left wrist with his left hand, taking it around his own neck and under his left arm, passes it to the right hand, which grasps it by the wrist. The whole weight is then thrown upon the right shoulder, and the left arm is disengaged. This may be done in the reversed way, and the right arm left disengaged.

Another method is to place the patient in a sitting position, and to pass a soldier's belt, or any broad continuous strap, behind the thighs at the popliteal space, and under the arms. The bearer then seats himself *dos à dos*, and, passing the strap over his own forehead, raises himself. The weight will then fall upon the shoulders and upper part of the back. The strap under the arms will prevent the patient falling through, as he will be somewhat wedge-shaped, the broader portion above, and the apex, formed by the buttocks, below. Both arms of the bearers are then disengaged. When two bearers are available, things are much easier.

The ordinary sedan-chair, as made by children clasping their wrists as represented in Fig. VII., is well known to you. This is only appropriate when the injured person is sensible, as he supports himself by placing his arms around the necks of the bearers on either side of him.

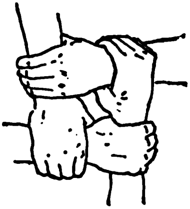


FIG. VII.

If he is not in sufficiently good condition to be trusted to supporting himself, the three-handed seat should be used, as represented in Fig. VIII.; and then the bearer whose hand is left free places it upon the shoulder of the bearer whose two hands are occupied, and thus a back is formed to the seat. A seat, but not so good a one as that just described, with a back to it, may be made by the bearers locking opposite hands, and placing their other two hands on opposite shoulders.

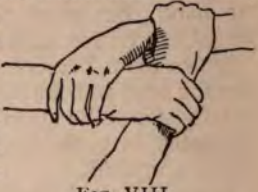


FIG. VIII.

If the patient has to be carried in a more extended position, or if quite insensible, the two bearers kneel down on the left knee only, and, passing their hands underneath the patient, lock them together. One pair of locked hands is placed below the shoulder-blades, and the other pair below the buttocks. The bearers then rise gradually to their feet, and move the patient by sideway paces.

The reason for going down on one knee only is to prevent any oscillation of the patient when getting up again, and which would occur if kneeling upon both knees.

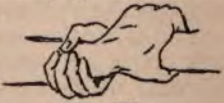


FIG. IX.

Then as to the manner the bearers should lock their hands: this is usually done wrongly. The bearer on one side should notice which way the other is going to pass his hands under the patient, so that he may pass his in exactly the reverse way. One passes his hands with the palms uppermost, whilst the other, passing his with the palm downwards, must keep close to the body of the patient, so that the bearer at the opposite side may pass his hands beneath his. Their hands will then be clasped in this manner (Fig. IX.), palm to palm, and held by the thumb on one side of the wrist and the fingers on the other. This is the only proper way of joining hands. More frequently, and wrongly, *do bearers interlock* their fingers, as in the child's game of "knives and forks"; and, consequently, if much weight has to be carried, great pain is experienced at the junction of the fingers with the back of the hand; but when palm to palm, any amount of weight can be carried without discomfort.

If two more bearers are available, one should support the head and the other the feet. If only one, then priority should be given to the head if the patient is insensible, or to the leg if that is the part of the body which is injured.

When patients have to be conveyed some distance, a stretcher is used.

There are in use different varieties of stretchers, and the one supplied to you (The Order of St. John litter designed by Mr. John Furley) is a very good one; it is of small weight, when shut up it goes into a small compass, and having under supports to it, the patient is kept off the ground when the stretcher is placed there.

Other stretchers have superstructures fitted to them to keep off the sun or the gaze of the passers-by. A very good and simple one is that used in many hospitals. It consists of a broad piece of red oilcloth, along the outer sides of which is a hem through which poles are passed, and a bar of iron, easily taken off, is placed on the poles at either end to keep the oilcloth on the stretch. Being red in colour, no blood shows upon it; the oilcloth is easily washed, and when the iron bars and poles are removed, it can lie upon the bed or operating table just as any other piece of waterproof sheeting.

An improvised stretcher can be easily made out of a gate, a shutter, or a door taken off their hinges, a hurdle, or even a short ladder.

Another, and an especially good stretcher can be made out of a couple of pilot jackets, both of which have their sleeves turned inside out. The neck portion of each coat is put as the ends of the stretcher, and through the sleeves are passed poles, sculls, or oars;

and the jackets buttoned up their whole length enclose the inverted sleeves with the oars running through them.

A railway rug, or a blanket on which a person is lying, may be used as a stretcher by placing a pole or a rifle, on either side of the patient, and rolling the sides of the rug around them. Two bearers on each side hold the poles out with the rug on the stretch. The weight of the patient is more evenly diffused by the two bearers on each side placing their hands close together where the centre of each pole is being supported.

The lifting of patients on to a stretcher, and carrying them thereon by words of command, is known by the name of "Stretcher Drill." These stretcher exercises have been drawn up by Mr. John Furley, and are purchasable at St. John's Gate, Clerkenwell. They are admirably compiled, and although not following quite the same lines as those supplied to the Army Hospital Corps, are, perhaps, better adapted for civil life.

When carrying a stretcher, two bearers are absolutely necessary—(if the stretcher is a door or hurdle, of course then four will be required), and it is better if possible to have three. Two (Nos. 1 and 2) to carry the patient, and one (No. 3) to support the injured limb when lifting the patient to and from the stretcher, to pay personal attention to the invalid whilst there, and to give orders or the words of command to the other two. When choice of bearers is possible, it is best to choose them of equal height, and then the adjusting of shoulder-straps, or even shoulder-straps altogether may be done away with. Otherwise the tallest, and strongest should be No. 1, and take the head and shoulders of the patient, which is the heavier part of the body.

First of all the stretcher should be placed in a line with the patient whenever it is possible to do so; the foot of the stretcher being placed close to the head of the patient.

This necessitates that some considerable space is at your disposal, and therefore when this is not available the stretcher may then be placed by the side of and parallel with the patient; that side being chosen upon which the injured limb is situated.

When the stretcher is in a line with the patient, No. 3 gives the word of command, "Fall in," and Nos. 1 and 2 place themselves on either side of the patient, and at the word, "Ready," raise him in the manner I previously described, kneeling on one knee, and being particular to remember that the hands, or rather the wrists, are grasped in the way I told you, and not with the fingers interlocked. No. 3 attends to the injured limb, placing both hands beneath it, but with one above, and the other below the seat of fracture.

At the word "Lift," all three bearers rise to their feet, and at the word "March," take short side-paces till the patient's head is over the pillow of the stretcher; then "Halt," "Lower," and the patient is placed gently down.

When the stretcher is by the side of the patient, all the three bearers kneel down on the opposite side of the patient to that on which the stretcher is, and raising the patient gently, lean forwards and place him thereon; or, if a fourth person is present, he passes the stretcher beneath the patient, whilst he is being supported by the other three bearers.

At the word of command, "Fall in," No. 1 bearer goes to the head of the stretcher and faces the head of the patient, whilst No. 2 goes to the foot of the stretcher and feet of the patient, with his back turned towards him. At the words, "Ready," "Lift," they stoop down, and lift the stretcher. On the word, "March," they start off, taking short paces about twenty inches in length, and in broken step, No. 1 starting off with his left foot, and No. 2 with his right.

It is very important that the bearers do not keep step, so that the patient may be carried steadily, and not swung from side to side.

A good example of the effect which would be produced if the bearers were to keep step is seen in the mode of progression of a camel, whose legs on one side of its body advance together, and consequently the rocking motion of the "ship of the desert."

An invalid should be conveyed by being as it were swung between the bearers by their arms; whilst movements of progression are carried on, the hips must be kept perfectly steady,—in fact, in a similar manner to that in which you see Italian image-men proceed when carrying statuettes upon a board posed upon their heads.

When the place of destination is reached, the words, "Halt," "Lower," are given, and the stretcher is placed on the ground. Then at the words "Unload stretcher—Ready" the bearers kneel down, and at the word "Lift" the patient is lifted off the stretcher in a similar manner to that by which he was put on, then at the order "March," side paces are taken, so as to get the patient clear of the stretcher, and over the bed, and finally at the words, "Halt," "Lower," the patient is placed upon the bed where he is to remain.

A special stretcher exercise is given for use in mines and narrow cuttings, where only two bearers can be employed. The bearers stand over the patient with one foot on either side of him, No. 1, as before, taking the upper part of the body and the greater weight; No. 2, the lower part. Passing their arms beneath the injured man, they raise him, and then by a series of forward movements lift him on to the top of the stretcher which has previously been put in a line with his head. If the patient is able he may greatly assist by passing his arms around the neck of No. 1.

A stretcher is never to be carried on the shoulders, for fear of the patient rolling off, and on account of being out of reach of administration by No. 3, if required. When going up a hill with a laden stretcher the head of it should be in front, and when going down hill behind, in order that the patient's head should not be dependent. The only exception to this rule is in cases of a broken leg or thigh, where the weight of the patient pressing downwards upon the broken limb would increase the suffering.

It is well to avoid, if possible, crossing a ditch or a fence, but when necessary, No. 2 reaching the impediment first, places the front handles of the stretcher on the top of the fence whilst he jumps over. The stretcher is then taken across, and then resting the handles at the head of the stretcher on the top of the fence, to allow No. 1 to get over, the ordinary course can be resumed. However, if a No. 3 is present, he could relieve first one and then the other, but it is better that he confine himself to looking after the injured person.

Horse ambulance carriages and litters can, for those persons resident in and about London, be obtained by applying to Mr. John Furley at headquarters, but for those less fortunately situated, some directions for the conveyance of the wounded by rail or road should be given.

Into some railway carriages it is impossible to get an ordinary-sized stretcher; and if such is the case, a first-class carriage should be chosen, and one with arms to the seats for preference, and then placing boards across between opposite seats, and covering the same with cushions, a bed can be made, from which the patient will move but slightly from side to side by reason of the arms to the seats, and it will in addition be parallel with the line of carriages, which gives less oscillation than when lying at right angles to it.

However, if a stretcher can be got into the carriage it must be suspended at right angles, as the ends of the stretcher are attached by ropes to the iron supports of the hat-rack on each side. The suspending ropes must not be taut, or too slack, as in the former they would transmit every movement to the stretcher, and if too slack any motion, once started, would cause the stretcher to oscillate like a swing.

When conveying an injured person in a country cart, a waggon with a tailboard to it should be chosen for the purpose. Some straw, furze, or bracken is placed in the bottom of the cart if no stretcher is used, and the patient laid carefully upon it.

If a stretcher is to be slung in the waggon this can easily be done in the same way that a stretcher is suspended in a railway carriage, fastening it by ropes to the open sides of the cart. The front handles of the stretcher are first rested upon the tail of the cart, whilst No 2 jumps up into the vehicle, to draw it into the body of the cart.

LECTURE V.

(For Females Only.)

Hints on nursing; Preparation of the room; the Bed; how arranged; Requisites for all emergencies treated of in the foregoing Lectures; Temperature of room; Reading ordinary and bath thermometers; Preparing the patient for bed, and placing him thereon, in various cases; Administering food, drink, medicine; Making and applying poultices of bread, linseed, mustard; Fomentations and Lotions.

THE subjects to be treated of in this lecture are all thoroughly entered into in the second or advanced course of lectures on "Nursing," and therefore I would refer you to Ambulance Lectures on "Nursing" for the requisite information to answer any question set on the above subjects. The style of questions you will be asked at the examination you will see by looking at the Specimen Questions I have appended to this book.

CHAPTER VI.

BANDAGING.

THE TRIANGULAR BANDAGE.

IN rendering first aid, you are taught how to apply the triangular bandage only.

The roller bandage is left for the nursing or advanced class. This is as it should be, because if you know how to apply the triangular bandage, you can always utilize the handkerchief you have in your pocket or about your neck; whereas a roller bandage is not always obtainable.

The different modes of doing up fractures have been already described in the third lecture, and it only remains for me now to show you how the triangular bandage may be applied to wounds or for keeping dressings on diseased or injured parts of the body.

There are one or two alterations which I should like to see made in the illustrated Esmarch handkerchief; so I have had a diagram drawn, and which is to be found at the commencement of this book, containing those proposed alteratious. I have adhered to the original as much as possible, and kept nearly to the same numbering, so that in my description of the different modes of applying the triangular bandage you can make reference to your illustrated Esmarch handkerchief.

The triangular bandage is a piece of linen or calico made by dividing diagonally into halves a piece of material about 35 inches square; and therefore a large-sized handkerchief folded in a similar manner answers the same purpose equally well.

Of the three sides of the triangle the longest is, of course, the base, or lower border, whereas the side borders are of equal length. The top corner, or apex of the triangle is called the point, the other two corners the ends.

It may be applied folded or unfolded. When folded, the point of the triangle is brought down to the base, or lower border, and then folded again and again in half until it is of sufficient width, either broad or narrow, to be applied to the part required.

The bandage is fastened by pinning the ends together with a safety pin, or by knotting them together in a "reef" knot (A, Fig. X.), which is one that will not slip—in fact, the tighter it is pulled the tighter it gets.

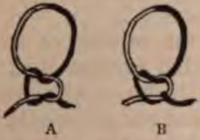


FIG. X.

The knot that a bandage should not be tied in, because it does slip, is the "granny" (B, Fig. X.), and which is the one usually tied by incompetent persons.

The accompanying diagram explains the difference between these two knots better than words can express.

Before applying a bandage to any injury, all blood and dirt should be removed, and those rules which were given you under the head of wounds, carried out; and remember to put a pad of linen rag or lint, saturated in cold water or olive oil, over the wound.

A capelline bandage for wounds of the scalp (9 and 21)* is put on with the triangular bandage much more easily and efficiently than with the roller bandage, and it is also much cooler. The lower border of the handkerchief, folded lengthways to form a hem 1½ inch wide, is placed on the forehead with the handkerchief covering the head, and the point hanging down the back of the neck. The two ends are carried round the head above the ears, and, crossing one another over the point, are brought back to the forehead and tied there. The point is then drawn upon, to get the part covering the head perfectly tight and smooth, so that no horns or creases are present, and the bandage looks as smooth as a bald head. The point is subsequently turned upwards and pinned on the top of the head.

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* The numbers refer to the frontispiece or diagram at the commencement of the book.

For wounds of the forehead (22), side of the face (10), or for the eye (8), the bandage is simply folded narrow, and, its centre being placed over the injured part, is tied on the opposite side of the head.

For wounds of the side of the head (17), with or without hæmorrhage from the temporal artery, a firm and hard pad, made of linen rag or paper, should be placed over the point of bleeding, and the bandage, folded narrow, is placed with its centre on the opposite side of the head to the wound, and being brought round to the pad, a half-twist is given to the bandage, to keep the pad in position. The ends are subsequently carried, one above the head and the other below the jaw, and tied on the side of the head where the bandage was first placed. This may be put on the reverse way if preferred, commencing with the centre of the bandage over the wound, and finishing with the knot at the same place.

For keeping dressings to a wound or poultices on the chest (20), the handkerchief is placed flat upon the body, with the point and one end downwards, the lower border being placed obliquely across the chest with one end going over one shoulder and the other under the opposite armpit; the point and the two ends are then tied together in the centre of the back (19). The bandage may be applied in a similar manner to the back when dressings have to be applied there (13 on the Esmarch handkerchief). To make a pelvic covering (25), the lower border of the handkerchief is placed around the waist, and the point passed between the legs is tied at the back to the two ends which have encircled the waist.

For wounds of the shoulder, or for keeping on dressings in disease of the joint (5 and 32), a hem is made in the lower border of the handkerchief and placed around the upper arm, the middle of the handkerchief covering the shoulder, and the point touching the neck. The two ends are carried round the arm, crossed and brought back again and tied. A second bandage, folded narrow, is passed over the shoulder on the injured side and under the armpit of the opposite side and tied there (30). The point of the first bandage is carried under and over the second one, as it lies on the shoulder and pinned on the top of the arm. This is a much better plan than passing the first bandage under a small arm-sling, as it is not necessary to interfere with the movements of the uninjured side.

For wounds of the hip, or for keeping on dressings in disease of the joint (31), the same arrangement as that just described is adopted, only the second bandage is passed around the waist and tied in front. The point of the first bandage is then passed under and over this and pinned on the outer side of the joint.

Wound of the throat (29) has been described under the head of wounds, page 38.

Wound of the upper arm (18), wound of the elbow (27), and wound of the forearm (26), are all treated alike. A bandage, folded broad, is placed with its centre over the wound, the ends are then carried round the limb, crossed and brought back again, and tied.

For wounds, or to keep on the dressing in a case of burn of the hand (3 and 7), the handkerchief is spread out, and a hem made of the lower border. The hand is then placed upon it, palm downwards, with the tips of the fingers towards the point, and the wrist upon the hem. The point is then turned over the back of the hand, and carried to the wrist; and first one side of the bandage and then the other is folded over the back of the hand, and the ends carried round the wrist, and tied. The upper part of the bandage fixed by that portion encircling the wrist, the point is then brought on to the back of the hand, and pinned there.

For a large arm-sling (4) the handkerchief is taken by one of its ends, which is placed over the shoulder of the uninjured side, whilst the point is carried below, and to the outer side of the semi-flexed elbow. The other end is now brought up round the injured arm, and, carried over the shoulder on this side, is tied to the other end at the back of the neck. The point is then brought forward round the elbow, and pinned in front.

For a small arm-sling (24) the bandage, folded narrow, is passed in the same way—first over the shoulder on the uninjured side, then below the semi-flexed arm, and over the shoulder on the same side, to meet the other end at the back of the neck.

For wounds of the thigh (6), or to keep dressings upon the knee (11), the bandage, folded broad, is applied in exactly the same way as for wounds of the upper arm and elbow.

For keeping dressings upon the foot (15 and 23), the handkerchief is spread out, and the foot placed upon it, with the toes towards the points. The point is brought up over the instep and the lower border, made into a hem, is carried up the back of the heel, and the ends, brought round the ankle in front of the point, are crossed on the instep, carried under the sole of the foot, and again crossing, are brought back again, and tied on the instep. The upper part of the bandage fixed by that portion encircling the ankle, the point is turned down on the instep, and pinned there.

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3. For Burn or Wound of Hand.
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30. Wound of Shoulder.
31. Wound of Hip.
32. Wound of Shoulder.
33. Fractured Clavicle.

CHAPTER VII.

SPECIMEN QUESTIONS.

LECTURE I.

1.—Give a brief description of the structure and functions of the human skeleton.

2.—Describe the structure and composition of one of the long bones of the body.

3.—What do you understand by the pelvis? enumerate the bones which enter into its formation.

4.—Enumerate the bones which enter into the formation of the thorax, and the chief muscles which help to close in that cavity.

5.—How are bones joined together; or, in other words, explain the structure of a joint.

6.—Describe the varieties of joints found in the human body.

7.—Describe muscular tissue.

8.—Describe the structure of the lungs.

9.—Describe the function and mechanism of respiration.

10.—Give the composition of ordinary air, and the changes produced in it by expiration.

11.—What is meant by ordinary breathing, complemental and residual air?

12.—Describe the function of the sympathetic nerve system.

13.—What are the respective functions of the cerebrum and cerebellum?

14.—Describe the function of the cerebro-spinal nerve system, and state what the result would be if the spinal cord was divided on a level with the third *cervical*, first dorsal and the first lumbar vertebra *respectively*.

LECTURE II.

1.—Give the composition of blood, and state how nature assists in the arrest of hæmorrhage.

2.—Describe the heart; its situation, structure, and function.

3.—Give the circulation of the blood, from the left ventricle round again to its entrance into the left auricle.

4.—The pulse. What is it, and how caused? its rapidity and relative frequency in infants and old people? stating whether it is present in both arteries and veins, and if not, why?

5.—What purpose is served by the circulation of the blood?

6.—What exceptions are there to arteries containing red veins and purple blood? giving the reason why.

7.—What are the differences between arteries and veins, in structure, contents, and function?

8.—Which are the chief points in the human body where digital pressure upon arteries can be most easily affected?

9.—How would you improvise a torniquet, say upon the femoral or main artery in the thigh?

10.—What is the difference between arterial, venous, or capillary bleeding?

11.—How would you know when an artery, or vein, or capillary is wounded? and how would you stop severe bleeding from the palm of the hand?

12.—Violent bleeding takes place from the cavity from which a tooth has been removed. What different measures would you adopt to arrest it?

13.—Mention the different modes of arresting bleeding.

14.—How would you treat bleeding from a ruptured varicose vein?

LECTURE III.

1.—Classify wounds and state how you would act in a case of punctured wound of the abdomen?

2.—Describe the different varieties of wounds.

3.—What first aid would you render to a case of cut throat?

4.—Which would heal quicker, an incised or a lacerated wound? and from which would you expect the greater hæmorrhage? stating your reasons in both cases.

5.—Give the general treatment applicable to all wounds.

6.—What is a sprain? and what immediate and subsequent treatment would you adopt?

7.—How do you distinguish fractures from dislocations?

8.—Describe the symptoms, the ordinary causes, and the classification of fractures.

9.—How do you know when a bone is broken? what accident might arise in moving a broken bone carelessly? and how do you fix a broken thigh?

10.—Give examples of fractures caused by direct and indirect violence and muscular action.

11.—What are the main points to be remembered in the treatment of fractures?

12.—What is the first indication in the treatment of fractures? and how would you carry it out in the thigh, in the forearm, and in the lower jaw?

13.—What do you understand by the following terms, as applied to fractures:—simple, compound, complicated, comminuted, and impacted?

14.—Why are fractures of the skull and of the ribs more generally serious than fractures in other parts of the body?

LECTURE IV.

1.—What do you understand by shock, and what *would be your* treatment?

2.—How would you distinguish between the following fits:—apoplexy, epilepsy, hysteria, and fainting?

3.—What are the different causes of insensibility, and how would you distinguish the one from the other?

4.—A man in a railway carriage has an epileptic fit. Describe his symptoms, and say what you would do?

5.—A man falls from the rigging of a ship, and sustains numerous injuries. He is insensible and collapsed: what would you do for him?

6.—Give the symptoms of, and first aid rendered to, a case of fracture of the base of the skull.

7.—A man falls from a stack of timber; he is quite sensible but cannot walk, having also lost sensibility in both legs. What do you suppose is the matter with him, and what assistance would you render?

8.—What is the immediate treatment to be adopted in dog-bites?

9.—A boy, in attempting to take a wasp's nest, is severely stung about the head and neck. What first aid would you render in such a case?

10.—How would you render aid to a man apparently drowned, who had just been taken out of the water?

11.—If a person's clothes were on fire, how would you extinguish the flames, remove the clothing, and dress the burns?

12.—A child attempts to drink from a kettle upon the hob, scalding the mouth and throat. What first aid would you render in such a case?

13.—Classify poisons and the first aid applicable to these varieties.

14.—Give the symptoms and treatment of opium poisoning.

Lecture V. *(for females only.)*

1.—What precautions would you adopt for warming *and ventilating* a sick-room in which is a case of incised wound of the throat, opening into the air passage?

2.—Describe a fracture-bed, and the necessary nursing preparations to be made for such an injury.

3.—State what preparations you would make in the bed and bedding for a case of fractured thigh, stating your reasons for every detail.

4. —What preparations would you think it necessary to make in the bed for receiving a patient suddenly seized with apoplexy?

5.—How would you pad a splint?

6.—What is the proper temperature of a sick-room? where would you place your thermometer, and how ventilate the room without lowering the temperature?

7.—Describe a clinical thermometer. Explain its use and how it is to be applied.

8.—How would you lift a patient from the stretcher to the bed, supposing three or four people were available?

9.—How would you undress a patient severely burnt, and what preparations would you make for dressing the burn?

10.—How would you undress a man with a broken leg, and how wash him before placing him in bed?

11.—What regulations would you make as regards the administration of stimulants for a patient who had been in the habit of taking them?

12.—How do you make a bread poultice, a linseed poultice, and a mustard plaister?

13.—Fomentations: how used and of what composed?

14.—How would you make a cold or evaporating lotion?

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